

Popular Mechanics

DECEMBER 1983

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Drivers
Who Plunge
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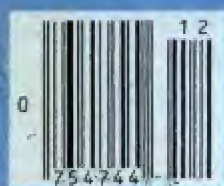


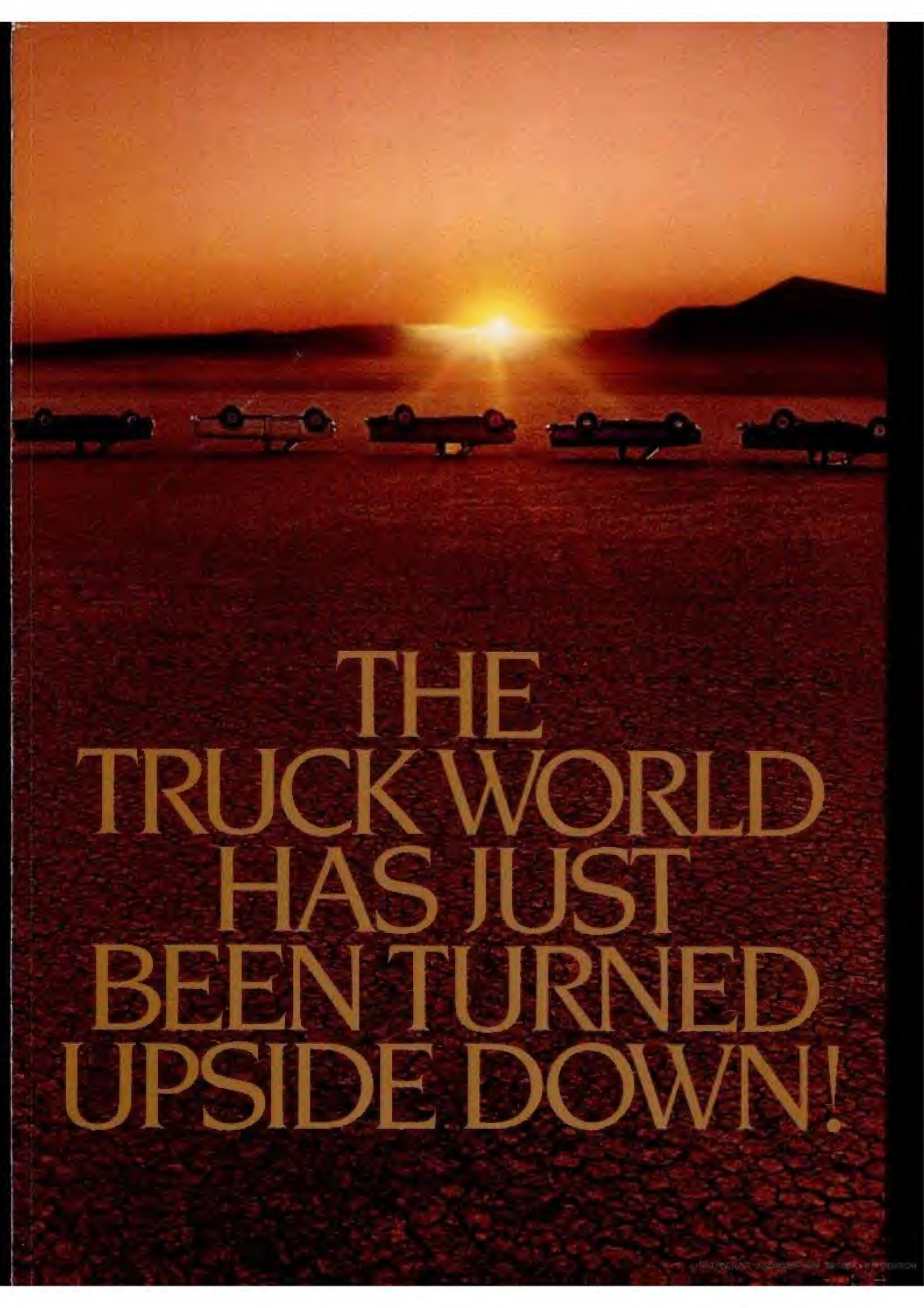
UP AND AWAY!
PM Editor Sails Off
In A Hot-Air Balloon



RUSTIC HIDEAWAY
Build A Log Cabin
The Country Way

CEILING BEAMS
How To Make And
Install Them (Plus
When To Use 'em)





THE
TRUCK WORLD
HAS JUST
BEEN TURNED
UPSIDE DOWN!

OH WHAT A FEELING!
TOYOTA



INTRODUCING THE NEW GENERATION 1984.

TOYOTA



TRUCKS!

The truck world has been turned upside down by the new generation Toyota trucks, because Toyota engineering is ready for 1984 with the most advanced trucks ever built. Here are just a few reasons Toyota has taken everyone by surprise:

TOUGHNESS. The new Toyota four-wheel drives are the new generation of the best-selling import truck in America. They're muscle trucks with a big, powerful 24 liter SOHC engine and the highest running ground clearance of any small 4x4 truck. For 1984 there's more Toyota durability than ever with tough, double-wall bed construction in most models. And in the Xtracab SR5,



automatic locking front hubs!

POWER. The first-of-its-kind Electronic Fuel Injection engineered into

a truck makes our 2-wheel drive SR5 models the most powerful Toyota trucks ever.

ROOM AND COMFORT. Toyota's totally new Xtracabs are a design breakthrough, carefully laid out to add XTRA space for XTRA comfort and XTRA cargo. Examples: Xtracabs' personal cargo space behind the seats for anything from tool boxes to water skis. Also, Xtracabs have the most leg room of any small truck in America!

In fact, every Toyota truck has more leg room than ever. More head and shoulder room, and actually more room to get in and out! Plus extraordinary comfort with the optional 7-way adjustable driver's sport seat.

STYLING. You don't have to be an engineer to

see that the exciting, new wedge-shaped slanted hood means new improved aerodynamics. Also contributing to the lowered drag coefficient are the new flush surfaces on the front and side windows for reduced wind noise. And there's lots more total glass area for improved visibility. This is just part of the aggressive story of Toyota's 1984 trucks — you'll have to see them for yourself.



CHOICE. Only Toyota offers you a selection of 16 models plus two cab chassis, even a ¾ ton with an 1,800-lb. payload!*

And many other choices — 2-wheel drive, 4-wheel drive, Xtracabs, regular cabs, standard beds, long beds, gas engines or new, more-powerful 24 liter true Diesels, 4-speed automatic

or 4 and 5-speed manual transmissions. So that you can have exactly the truck that suits you.

ECONOMY. If all that didn't turn the truck world upside down, this one would by itself — Toyota's lowest-priced truck at \$5,998!**. It's the new generation standard bed with 3-across seating plus a big, powerful 24 liter SOHC engine, powering a 1,400-pound payload!*

\$5998**

Buckle up in one of these hefty beauties. You'll be right side up not only because of the engineering excitement, but because Toyota trucks are tough and gutsy and tons of fun. And you'll see why we're turning the truck world upside down!

* Including occupants, equipment and cargo.

** Manufacturer's suggested retail price. Dealer's actual retail price may vary. Price does not include tax, license, transportation, optional or regionally required equipment.

MOST ADVANCED TRUCKS EVER BUILT!

**YOU'LL BE RIGHT SIDE UP
IN THE MOST ADVANCED TRUCKS
EVER BUILT.**

This One



WKH4-HPP-39HR



PLAYERS GO PLACES

Meet Players.

Regular and Menthol
Kings and 100's.



Kings: 12 mg "tar," 1.0 mg nicotine—100's: 14 mg "tar,"
1.1 mg nicotine av. per cigarette, by FTC method.

Warning: The Surgeon General Has Determined
That Cigarette Smoking Is Dangerous to Your Health.



Radio Shack Gift Ideas

Celebrating Our 63rd Christmas of Bringing Technology
From the Laboratory to the Living Room, Affordably!

LED Alarm Clock With 12 or 24-Hour Display



Great for hams and computer users! Easy-to-read display, switchable 12 or 24-hour format. Battery backup keeps time and alarm running if AC power fails. #63-760

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Sensitive dual-conversion circuit spots all types of radar with a warning light and/or tone. Mounts easily on visor, dash or windshield. #22-1608

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3195

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Our finest analog VOM measures AC and DC volts, DC current, resistance and decibels. Big 5" scale. Fused and overload protected. With leads, probes and manual. #22-210



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LETTERS TO THE EDITOR



Is the Chicano Bug a real Beetle?

I feel your article *Return Of The Beetle* (page 170, Sept. '83) was unfairly negative.

In my opinion, Mexican-made VWs are, in fact, built to a satisfying degree of quality. I still own and drive a 1973 Safari, which also was manufactured in Mexico, and I find its workmanship to be as good as that on the original Beetles from Wolfsburg.

I personally would prefer buying a brand-new Mexican Beetle to any other car on the market. The Bug was, and is, unique among automobiles. The public needs a vehicle that's uncomplicated

and easy for a do-it-yourselfer to maintain. Why knock it?

PETER NAVINS
GERMANTOWN, N.Y.

Your piece on the Chicano Bug only scratched the surface of the car's true problems. The handling very definitely leaves much to be desired, probably because of poor springs and shocks, in addition to the dangerous rear swing axle. The swing axle was abolished in 1969 on the German-made Beetle. It's a menace.

As you correctly pointed out, the car

is geared lower than earlier VWs, necessitating more shifting. And there's no tachometer, so you can't tell exactly when to shift. In addition, the home-brewed emissions system easily gets out of whack and is difficult to work on.

The whole point of the original Bug was that it was a dokey but functional design whose appeal lay in meticulous workmanship, ease of maintenance and superb economy. The Mexwagen hardly qualifies.

CHRIS HARRY
LEAWOOD, KAN.

Seeing stars

As a Subaru owner since 1973 (now on my sixth car), I think Bill Hartford is "off the road" with his comment that Subaru should "dump the dumb badge with all the stars" (*Imports & Motorsports*, page 10, Aug. '83).

I think the emblem is one of the prettiest on the road and, besides, there is a delightful story that goes along with the symbol.

In Greek mythology, the six stars in the cluster called Pleiades represent the six daughters of Atlas roaming the heavens for all eternity in search of their lost sister, who was banished by Zeus for the crime of falling in love with a mortal.

RICHARD T. PRATT
PETERBOROUGH, N.H.

We must also note that Subaru is the Japanese name for Pleiades, so it would seem that Subarus do, indeed, have a right to be starry-eyed.

A merry PM Christmas

Here's a photograph of your circus wagon toybox (6 *Fun-To-Make Toys For Christmas*, page 118, Nov. '75). It made a great Christmas present for our granddaughter last year.

I added steerable front wheels with a handle. Instead of making the sides of plywood, I lined the cage bars with clear Plexiglas. This keeps small toys from falling out, but makes the contents visible. I have received many



PM's circus wagon toybox built by reader Kampilla. See-through sides are plastic.

compliments on the wagon, and our granddaughter loves it.

RICHARD KAMPILA
HANOVER, MASS.

You added some nice touches. For others who may be interested, photocopies of the article are \$4 postpaid from *Popular Mechanics*, Box 1014, Radio City Station, New York, N.Y. 10101.

Computer compliment

Your article *Choosing The Computer That's Right For You* (page 83, Aug. '83) had one of the best sets of comparison charts on home computers.

CHUCK STINSON
PHOENIX, ARIZ.

Compressor tip

In your *Appliance Clinic* for September '83 (page 16), a reader asked what

could be used as a vacuum pump for doing repair work on refrigeration systems, short of buying an expensive pump made for the purpose. You suggested a pump could be rented if the need was only occasional.

I do similar repair work and have found that a compressor from almost any old, discarded refrigerator can be used as a vacuum pump and usually costs little or nothing. I thought your readers might like to know about this possibility.

E.K. LEAR
TUJUNGA, CALIF.

Unintended slip

It has come to our attention that your article *The Bike That Ate Up New York* (page 166, Mar. '83) contained several references to the Stumpjumper bike as a "fat-tire flyer."

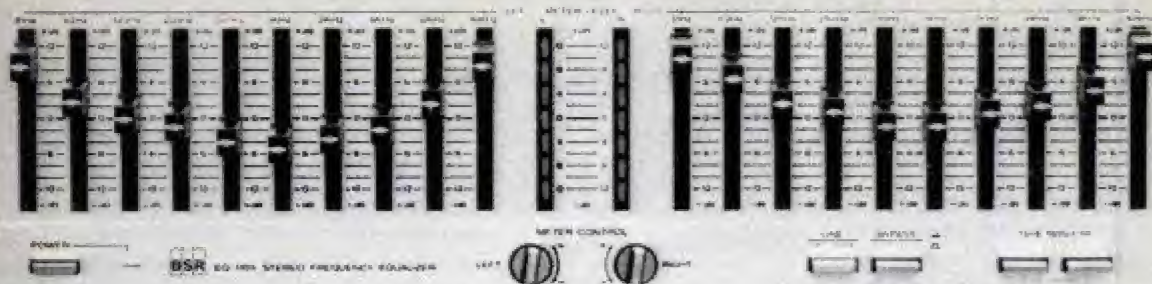
Since Fat Tire Flyer is a registered trademark of Fat Tire Flyer magazine, any use attaching this name to any other product constitutes an infringement of trademark.

We assume your use of the trademark was made in ignorance. However, a trademark is meaningless unless it is protected. Therefore, we must protest this infringement.

CHARLES B. KELLY
EDITOR, FAT TIRE FLYER
FAIRFAX, CALIF.

We regret the misuse of your trademark. It was unintentional. **PM**

\$89 CLOSE-OUT



Sound Detonator Plus

Make your stereo system's sound explode with life. Improve the sound quality by 30 to 50%. Plus, you'll add tape dubbing too with this limited BSR \$89 close-out.

It's like night and day. Crashing cymbals, the depth of a string bass, more trumpets or more voice will come bursting forth from your stereo at your command.

You'll make your music so vibrant that it will virtually knock your socks off when you use this professional quality 10 band stereo Sound Detonator Plus Equalizer.

It has a frequency response from 5hz to 100,000hz ± 1 db. BSR, the ADC equalizer people, make this super equalizer and back it with a 2 year limited warranty. Our \$89 close-out price is just a fraction of its true \$249 retail value.

CAN YOUR STEREO SOUND BETTER?

Incredibly better. Equalizers are different from regular bass and treble controls. And, 10 band EQs are the best.

Bass controls turn up the entire low end as well as the low mid-range, making the sound muddy and heavy. With an equalizer, you simply pick the exact frequencies you want to enhance.

You can boost the low-bass at 31hz, 62hz and/or 125hz, and the mid-bass at 250hz and 500hz to animate specific areas of the musical spectrum.

And, when you boost the part of the bass you like, you don't disturb the mid-range frequencies and make your favorite singer sound like he has a sore throat.

The high frequencies really determine the clarity and brilliance of your music.

You can boost the mid-range and highs at 1,000hz, 2,000hz, 4,000hz, 8,000hz and 16,000hz. So, you can bring crashing cymbals to life at 16,000hz while at the same time you cut tape hiss or annoying record scratches at 8000hz.

You can also boost or cut specific mid-range frequency areas to add or subtract vocal, trumpets, guitars or whatever instrument ranges you prefer.

GREAT FOR 2 TAPE DECKS

You can push a button and transfer all the equalization power to the inputs of two tape decks. So, if you have a cassette deck in your car or a personal stereo that you wear, now you can pre-equalize your cassettes as you record them.

Now you can get all the dramatically enhanced sound wherever you are. This

is an especially great feature for bass starved portables and high-end starved car stereos to make them come alive.



And, look at this. There are two tape inputs and outputs, so you can dub from tape deck A to B, or make two tapes at once with or without equalization.

EASY HOOK UP

Use your tape monitor circuit, but don't lose it. Now your one tape monitor circuit lets you connect two tape decks.

Just plug the equalizer into the tape 'in' and 'out' jacks on your receiver. We even supply the cables.

As you listen to your records, FM or 'aux', any time you push the tape monitor switch on your receiver you'll hear your music jump to life.

The output from your receiver is always fed directly to your tape decks for recording, and with the touch of a button, you can choose to send equalized or non-equalized signal to your recorders.

When you want to listen to a tape deck, just press a tape monitor button on the equalizer and your tape deck will work exactly as it did before. Except, that now you can choose to listen with or without equalization and you can dub.

You won't be listening to any distortion or hum. The Sound Detonator Plus has a 95db signal to noise ratio and total harmonic distortion of just 0.018%.

Once you've set your equalizer controls, switch it in and out of the system. You'll hear such an explosive improvement in sound, you'll think you've added thousands of dollars of new equipment.

WHY A CLOSE-OUT?

Last year DAK closed out over 18,000 of BSR's 7 band equalizers because BSR had decided to only sell equalizers under their ADC name and they still had some left with the BSR name on them.

Well, as Detroit comes out with new cars each year, ADC comes out with new equalizers. We got them to supply us

with just 15,000 of last year's model before they shut down for the new one.

They had already paid for all the tooling, all the research and design, so we were able to buy these for less than half the normal price, for cold hard cash.

So, you can go to any HiFi store and buy this year's design in an ADC equalizer made by the parent company BSR, or you can get this \$249 value BSR equalizer while our limited supply lasts, for \$89.

THE FINAL FACTS

There are 20 slide controls, each with a bright LED to clearly show its position. Each control will add or subtract up to 12db. (That's a 24db range!)

There are separate sound detonation slide controls for each channel at 31hz, 62hz, 125hz, 250hz, 500hz, 1,000hz, 2,000hz, 4,000hz, 8,000hz, and 16,000hz.

LED VU meters with ± 0.5 db accuracy show levels for each channel. It is 17" wide, 6 1/2" deep and 4 1/2" tall.

PUT LIFE INTO YOUR MUSIC RISK FREE

Prepare for a shock the first time you switch in this equalizer. Instruments you never heard in your music will emerge and bring a lifelike sound that will envelop you and revolutionize your stereo system.

If your system doesn't spring to life, simply return the equalizer within 30 days in its original box for a refund.

To order your Sound Detonator Plus Tape Dubbing BSR 110X 10 Band Stereo Frequency Equalizer risk free with your credit card, call toll free or send your check not for ADC's \$249 value, but for only \$89 plus \$7 for postage and handling. Order No. 9724. CA res add 6% tax.

Wake up the sound in your stereo. Your sound will explode with life as you detonate each frequency band with new musical life. And now you'll be in control of two tape decks as an added plus.



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EDITOR'S NOTES

When a guy manages to solo a backpack, hot-air balloon (cover and page 75) for the first time, you'd think someone would pin wings on him. Not so. Ray Hill discovered. Matter of fact, Ray became the centerpiece of a little ceremony that seemed designed more to remind him of terra firma than of the wild blue.

Tradition has it (as Ray was told) that a first-time balloonist is tapped on the forehead with grass from his landing spot while champagne is being poured on his head.

Whether the ritual is time-honored tradition or whether it was invented on the spot for Ray, he took it in stride. Just the way he took his first balloon flight—as well as his second appearance on PM's cover in four months. . . . **PM's mobile office** (page 78) may appear to be one of those projects that looks great in photographs, but, well, does it really work? It does. It's in daily use, as a matter of fact, by a group of four magazine execs who use the Apple computer for an hour each trip as they commute to our offices. The only complaint so far: One of the group accidentally tripped the power switch for the computer and wiped out an hour of work. But, then, that could happen at home. . . . **Ever yearn for your own kind** of Walden Pond experience? Build a cabin in some remote spot and retreat there to contemplate Life? Michael Chotiner, who traveled to Minnesota last winter to learn log-cabin building, has lots of good construction advice in *Build A North Woods Retreat* (page 96). But he adds one further word: Pick summer, not winter, to erect the cabin, especially if you live in Minnesota. . . . **Fans of Brad**



A first-time balloon solo brought Ray Hill this sort of attention from Tony Chace (left) and ground crew.

Sears, host of the weekly public television series *Last Chance Garage*, can check him out as an author while learning about *Getting The Most From Your Battery* (page 37). The popular acceptance of his car-care television series is a result, we believe, of the same thinking we apply to our own *Saturday Mechanic* series: Anyone can do it if it's explained clearly enough. **PM**



TV's Brad Sears takes a guest spot in this month's *Saturday Mechanic* (page 37).

John A. Lillenton

POPULAR MECHANICS • DECEMBER 1983

The \$7 FM Stereo Masterpiece



Thunderingly vibrant, larger than life, brilliant FM stereo sound will engulf you as you put on the stereophones of this state of the art personal FM stereo. It's all yours for just \$7. But, there's a catch.

It's no Hong Kong cheapie. Your FM stereo sound will explode with life.

In a market flooded with Hong Kong look-a-likes, this incredible Japanese crafted personal FM stereo from MGT, (the super tweak auto-stereo company), was simply too expensively built for the market during the last recession.

So, DAK was able to buy (steal) all 64,000 of these audiophile quality personal FM stereos for cold hard cash.

Each is complete with super feather-weight headphones, leatherette carrying case and two standard AAA batteries. You get everything for just \$7, but don't forget, there's a catch.

MICRO-SIZE/MAGNIFICENT SOUND

MGT has produced an FM tuning circuit of incredible quality using three 16 pin integrated circuits. For those of you who are electronic nuts as I am, even the resistors are gold banded 5% prime as used in only the very finest equipment.

So, you'll have the finest circuit and the best components to give you remarkably drift free ultra clean FM stereo sound.

Most fine stereo equipment is designed to be lovingly placed on a shelf and never moved. Obviously, this isn't a practical way to listen when you're walking your dog, jogging or mowing the lawn.

So, whether you're working in your office with the Stereo Sports unobtrusively sitting in your shirt pocket, skiing down a fast slope, or just lying on your backyard hammock, you'll have massively powerful, breathtakingly crisp, FM stereo music anywhere.

CHALLENGE YOUR HOME STEREO

This tiny FM receiver (it's only about the size of a standard cassette), will easily slip in your shirt pocket, yet it's so powerful it can challenge your home stereo.

So, here's our challenge. Start at 88MHz on the bottom of the FM dial. And, station by station, compare the reception to your current home stereo.

You're sure to leave virtually any other personal stereo of any size in the dust, and MGT's dramatically alive FM stereo sound will even give a top of the line home FM tuner a run for its money.

TECHNOLOGY PLUS

Everything is automated. An extra large LED shows when the circuit automatically switches to stereo reception. And, there's no on/off button. Just plugging in the headset turns it on and off.

The headphone cable becomes a sensitive FM antenna. The leatherette case attaches to your belt. And, there's a wrist strap to make it easy to carry.

But, frankly it's the smaller than shirt pocket size and the incredibly pure sound that make this an audiophile's delight.

MGT made the Stereo Sports in both high-tech black, or white with blue accents. Whichever you choose, it's backed by MGT's standard limited warranty.

THE CATCH

Frankly we are losing our shirts on the FM stereo masterpiece, but we're looking for audiophiles who use cassettes.

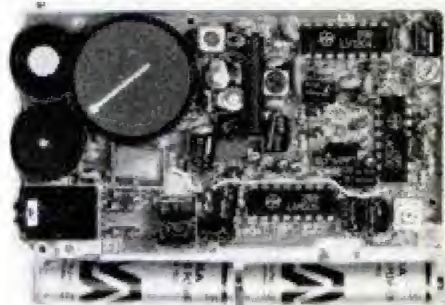
If you buy top name TDK and Maxell cassettes, you probably pay \$3.50 to \$4.50 each for a 90 minute cassette.

We want you to try DAK's new Gold Label MLX ultra high energy, normal bias cassettes. Not at \$4.50 or even at \$3.50, but at a factory direct price of just \$2.49 each for a 90 minute cassette.

We challenge you to compare the frequency response, dynamic range and signal to noise ratio of our new Gold Label MLX to Maxell UDXL or TDK SA. If they win, we'll not only give you back



Shirt pocket size and massive, earthshaking sound are now made possible in this audiophile quality FM personal stereo. 3 integrated circuits and gold banded 5% prime resistors make your FM stereo come alive.



your money, we'll give you a free gift for your trouble. And, DAK's come with a deluxe hard plastic box, index insert card and a limited one year warranty.

WHY, YOU MAY BE ASKING?

You're very valuable to us in the form of future business. Over 330,000 customers have responded to bonuses like this. We find most of you keep buying once you've tried our cassettes and our prices; and that's a worthwhile gamble.

NOT A BAD CATCH

DAK manufactures a cassette with no problems and great sound. We've been hot on the heels of the frequency responses of Maxell and TDK. The tape we made last year had a great frequency response up to 14,000hz.

Now, our new Gold Label MLX is second to none. We have a frequency response to 19,500hz and we'll go head to head against any tape on the market.

TRY NEW DAK MLX90 CASSETTES RISK FREE

To get the audiophile quality FM Stereo Sports complete with headphones, case and batteries for just \$7, try 10 MLX 90 minute high energy cassettes. If you're not 100% satisfied, return only 9 of the 10 cassettes and the Stereo Sports in its original box within 30 days for a refund. The 10th cassette is a gift for your time.

To order your 10 Gold Label MLX 90 minute DAK cassettes and get the fabulous Stereo Sports FM Personal Stereo for only \$7 with your credit card, call toll free, or send your check for \$24.90 for the 10 tapes, plus \$7 for the Stereo Sports, and \$3 for postage and handling for each group. CA res add 6% sales tax.

Use Order Number 9711 for High-Tech Black or Order Number 9712 for White with Blue accents.

You'll have massive 20hz to 20,000hz audiophile FM sound from the Stereo Sports, and great audiophile sound from DAK's MLX 90 minute cassettes.



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PM ELECTRONICS MONITOR



Television is going high-tech

Some startling new products that will make video more attractive to both the at-home director and the viewer are here now, or soon will be.

Sony's new "Betamovie" should be available in stores by the time you read this. And, if you've ever lugged around a "portable" videocassette recorder (VCR), complete with power supply and separate camera, you'll find a great weight lifted from your shoulders. This new Betamovie device incorporates a record-only VCR and a video camera in one unit.

Weighing in at only 5½ pounds, the new unit solves some of the weightier problems of on-the-go recording. While there is still need for a separate power supply, the supply is smaller, too, and is even available to wear on a battery-holding belt.

And, for the stay-at-homes, Sony is also offering new, nonportable VCRs. Two of the newest (the SL-2401 and SL-2410) feature a built-in voice synthesizer. The synthesized voice will

chide an unwary user who makes an error setting the VCR's programmer, forgets to load a cassette into the unit, or uses a cassette with the safety tab missing.

Still missing from the VCR lineup is a model that will deliver a raspberry when a particularly obnoxious sitcom is viewed.

Meanwhile, Panasonic's PK-G900 is a new home video character generator which will allow videophiles some at-home, studio-style facilities. Basically, the unit allows for video to be captioned with typed-in words or phrases.

It has a full range of automatic features: The date and time can be inserted instantly on the video, while captions may be stored in the computer-style memory one day and then used on video up to a year later.

Panasonic's Japanese division of Matsushita is working on a new digital television set that will be on sale in Japan sometime next year.

This multifunction TV will incorporate built-in adapters for teletext and videotex (the transmission of words and still pictures for at-home databases). The television will also allow two video sources to be watched at the same time via a 6-inch screen that is computer-inserted on the main 20-inch image.

And, obviously hoping that videotex becomes a reality, Matsushita also has announced a 6.3-inch portable TV that will fold into an attaché case. The collapsible TV will be a tiny version of larger rear-screen projection TVs and is specifically designed to sit on a desk when unfolded, as both a TV and a terminal.

Meanwhile, back on this side of the Pacific, Zenith says that all of its new "Advanced System 3" sets will allow for the addition of a videotex decoder box. This accessory will let American television sets function as at-home terminals once such services are in demand.

Now if only what's on TV were of the same quality as what's in it.

Get clean

Ever try to clean cat hairs out of your computer's keyboard? If that or other disasters plague you, check out a very handy tool called the Mini-Vac (from Pine Cone, Box 1378, Gilroy, Calif. 95020). It's a miniature vacuum cleaner and is just what the computer doctor ordered. It also keeps cameras and lenses in fine shape.

Coleco announces plans

As of late September, Coleco had not yet delivered its Adam computer to stores. But the company has already announced multiple deals with various large corporations to support their new computer system.

With AT&T, Coleco will be going into a joint venture to develop interactive games and entertainment for the home. The games would use existing telephone lines and a special modem from Coleco/AT&T. The company also announced a deal with StarCom to bring the fantastic laser-disc-based video game *Dragon's Lair* into the home.

As soon as Coleco delivers working units of its new Adam computer (rather than nonproduction prototypes) we will examine this system in greater detail. All indications are that it will be a super computer system.

UPDATE

The Coty-29 color television picture tube (*PM Electronics Monitor*, page 16, June '83) will be produced by RCA, Zenith and GE. It will not be manufactured by GTE Sylvania. **PM**

Making Graphics Easier

A light pen will help you to access a computer's graphics capability. Point it at a screen and a light sensor will tell the computer where on the screen you are pointing. Software will interpret the information and allow you to "draw" on-screen.

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DETROIT LISTENING POST



Engine noise

There are interesting rumblings coming from the engine departments all over town.

At Chrysler, the Direct Connection factory go-faster guys are getting ready to offer air-to-air intercooling for the turbo 2.2-liter Four.

The addition of an intercooling kit will do magical things for the power output of the little Four, as Volvo found out this year. It's quite possible that the company first will offer the air-to-air unit on the factory option list of the Shelby Charger. Shelby himself has been experimenting with superchargers and getting impressive results, especially in mid-range torque, which is what you want on the street, rather than a turbocharger's high-rpm power.

Chevrolet's interest in high-output motors is well established. But why has one of the internal departments in the bow-tie division asked a supplier to cast original ZL-1 engine blocks? Not a new, neutered version, but real T356 aluminum ZL-1s. This 427-cu.-in. monster motor, I've been told, may find its



Only 69 of these rare 1969 Camaros (above) were built with the aluminum ZL-1 engine.

home in racing cars similar to the Corvettes and Camaros that formerly carried it from the factory gates, or maybe in the new Corvette GTP car built for IMSA road racing. The interesting part is that the engine could be available over the counter of your local Chevrolet store, for installation by garage work-light in suburbs all over America. Pushing out 430 street hp with a 12.5:1 compression ratio, what does one feed it? Raw meat?



Street-legal ZL-1 engine produced 430 hp and 450 lb.-ft. of torque from 427 cu. in.

On the money at AMC

Expect to see what may evolve as America's lowest-priced convertible in the Alliance line by 1985, tipping the scales at \$9,000 or less.

Sources are now predicting that the Eagle line will be on its way to extinction by that year, finally giving up the ghost before the advent of the '86 model year. This means the 4wd turbo Alliance wagon should debut in the Eagle's stead, as well as a sedan version of that car with the same interesting components. A 4wd edition of the Renault 18i SportWagon will also be in the mix.

Trouble at Bowling Green

Nagging difficulties with the beautiful new '84 Corvette continue to plague America's first true sports car (can't say *only* anymore, can we?).

Last June, about 4,000 new Corvettes were recalled for replacement of bolts in the brake caliper assembly.

They had received the wrong protective coating at the supplier, so they not only failed to inhibit galvanic action between aluminum and steel parts, but also became so slippery that, when torqued down, they refused to stay down.

As this is being written, about 13,800 Corvettes are being called back to remedy two more glitches.

Testing at GM's proving ground disclosed a tendency for the power steering pump pulley to flex outward, causing the belt to loosen or be thrown. The pulley will be replaced by dealers, free of charge, of course. In the same visit, dealers will insulate the positive battery cable from its clamp. In some cases, normal operation of the Corvette can cause the clamp to slice through the cable covering as deeply as the copper, creating a potentially nasty surprise.

We've heard about other problems, too, which are mostly just the irritating little bits ultimately worked out of any

brand-new design. Seems the unique Goodyear Gatorback tires, specific to the Corvette, tend to throw snow up into the car's wheel housings, where it sticks. Enough snow can get packed in there, we're told, to affect steering. Some Corvette LCD dashboards have experienced failures, too. The unique Corvette manual transmission, the 4+3 which provides computer-controlled overdrive in the top three gears, was also delayed beyond initial introduction dates because of developmental gremlins. The transmission's problems, however, are said to have been solved, and the unit is available to buyers as you read this. In fact, we used one of the first stick Corvettes in a recent monster Corvette vs. the World road test. Look for it next month.

SVO Tempo from Ford?

Well, yes and no. Ford's Special Vehicle Operations *did* put a prototype (Please turn to page 16)

Extra-wide interior
Ban-Rol® prevents
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DETROIT LISTENING POST

(Continued from page 14)

together a few months ago, at the request of the Ford bigwigs. The SVO car, however, carried the turbocharged 1.6-liter CVH engine that is also used in the EXP Turbo. The Tempo, on the other hand, uses Ford's 2.3-liter HSC Four in regular issue.

What's going to happen, then, is that the mainstream Ford folks will put together their own Tempo turbo variant for "about 1985 1/4," my Ford guy says, using pointers from SVO but neither the 1.6- nor 2.3-liter engines. The

hot Tempo derivative will feature a 2.5-liter, turbocharged Four, boosting the performance of a car which some have likened to the Chrysler Airflow of the 1930s.

The sales job done for Ford by the Tempo is better by any measurement than the job done by its Fairmont predecessor.

But the high-output Tempo will bring a new, necessary identity to that car line—important primarily because the Tempo stands to be overwhelmed when the European Sierras are introduced to the U.S. in all their promise of glory.

More Chrysler mini-rockets

More good things are coming from the Chili Maker. Carroll Shelby is putting together a killer namesake edition of the Rampage, Chrysler's L-body pick-up takeoff. My Chrysler source indicates the 2.2-liter HO Four will go under the hood, with the necessary musclebuilding under the fenders.

Also pending from Chrysler is the Highland Park Rabbit GTI killer, the Omni GT. With an improved suspension and the ubiquitous 2.2-liter turbo Four, Dodge sources claim the little commuter will have the potential to suck the doors out of Volkswagen's quick Rabbit GTI.

You'll be seeing a lot in print about Plymouth's little Colt GTS (made by Mitsubishi). I just spent a week in one, and it's one of the liveliest and *fastest* cars I've driven in a long time, with 0-60 runs in the low eight-second area. Body roll ranges from seldom to never. This is a cult car aborning!

C-Car snapped

Last month, we told you we'd seen Oldsmobile's new front-drive C-car, but we couldn't photograph it. Now we've got spy photos of the Cadillac version—the front-drive Sedan de Ville.

It has the same big side windows, formal roofline and short trunk as the fwd Olds 98. It was originally scheduled for a fall '83 introduction, then put off until the winter. Production startup is now scheduled for early December. Unofficial word is that the corporate



Spy shots of front-drive Sedan de Ville show off the distinctive C-car "formal" roofline.

automatic transaxle is giving reliability problems on these bigger cars, and GM brass does not want to issue another front-drive recallmobile. "It's the largest quality improvement program in our history," says a source at Cadillac. "We've got hundreds of cars now being tested."

FM

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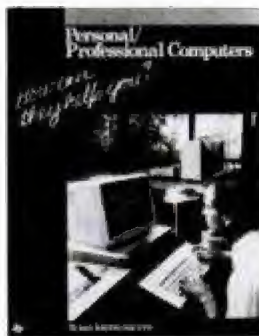
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This is the 1984 Mercury Marquis. There are two ways to find out how much it costs. You could look down at the bottom of the next page. And be mildly surprised. Or read the next few lines in between. Then the price.

And be pleasantly shocked. Because this is not a stripped-down version of a new car. But one with a standard equipment list that includes power steering, power brakes, automatic transmission, and individual reclining Twin Comfort Lounge seats.

As well as optional features already included in its price that usually end up as painful additions to the price tag of most new cars.

Like air conditioning, white sidewall steel-belted radial tires, wire-styled wheel

covers, right-hand remote-control convex mirror, and AM/FM stereo.*

Hardly the kind of car you'd associate with a low price.

Yet all these comfort features are also matched with the kind of advanced technology you should expect in a 1984 automobile.

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Get it together—buckle up.

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This Marquis also offers a feature that's becoming hard to find at any price. Room.

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CAR
CLINIC

Hunting for a solution

I recently purchased a used 1980 Chevrolet Impala with a 305-cu.-in. V8 engine and a clutch-type torque converter transmission that's giving me fits. At 43 to 55 mph, the transmission can't make up its mind to shift up or down and gives the sensation of a bad engine miss. Mechanics at a Chevy agency and independent transmission shop told me the same thing—"normal

for this car." I can't believe it. Help, please.—Dale Seer, Bloomsburg, Pa.

Normal, my foot. The solution for a 1980 GM torque converter clutch-type transmission that "hunts" is to replace the governor pressure switch—in your case with one having part No. 8633363. This can be done without removing the transmission from the car.

Leak in Lakeville

A short time ago, I bought a 1978 Chevrolet pickup truck that's equipped with the 350-cu.-in. (5.7-liter) Oldsmobile diesel engine. It's leaking oil from the rear main seal. I replaced the seal once, but after a few miles the leak started again. Can't I stop it?—James Smith, Lakeville, Ind.

You can, but you have to use the correct adhesive. It is not the one recommended in the service manual. (All other instructions in the manual should be followed.)

Glue the seal into place with a super adhesive made by Fel-Pro (No. 361) or Loctite (No. 414). You get the Loctite product if you buy the seal from a GM dealer using part No. 1052621.

See that the bearing cap and seal grooves are clean. Then, coat the seal grooves with the glue. Don't leave gaps. If you do, the seal will bunch up and create a space through which oil will leak. When it comes to installing the upper seal, you have to remove the crankshaft.

Rx: A salt-free diet

I have a 1977 Dodge Aspen with a six-cylinder engine that keeps stalling in wet weather, especially as the engine idles. The problem has come about in the past year. The dealer replaced secondary ignition cables and the distributor. He also tested the fuel system, but can't eliminate the problem. I need suggestions.—Frances Mazza, Middle Village, N.Y.

It sounds like an electrical problem. If it were a fuel-related condition, the engine would also stall in dry weather. To find out which electrical part is

weak, let the engine idle. Lift the hood and mentally divide the engine into zones. Then, using a small spray bottle filled with water, lightly spray each zone to see if the engine stalls. Also spray electrical connectors attached to the firewall and fender housings. When the engine stalls, determine which electrical components are involved and check each of them.

Look for cracks, corrosion and similar signs. If you can't find physical evidence of a fault, you may have to substitute-test with new parts.

If you asked me to guess which part is most likely causing the trouble, I'd include the ignition coil in the first zone you test. Water can easily interfere with the coil's operation.

Bad vibes

My 1983 Honda Accord runs great when first started, but about one-half hour later a bad vibration develops in the steering wheel, dashboard and front seat. It happens only when the engine is idling with the automatic transmission in DRIVE or REVERSE—never in NEUTRAL or PARK. Simultaneously, the tachometer needle drops from about 950 rpm to about 450 rpm.

The dealer has worked on the car nine times—even installed a new carburetor. Now he tells me this is normal. The car is less than five months old. What should I do?—Michael Mombrea, Buffalo, N.Y.

Do this, and do it in this order:

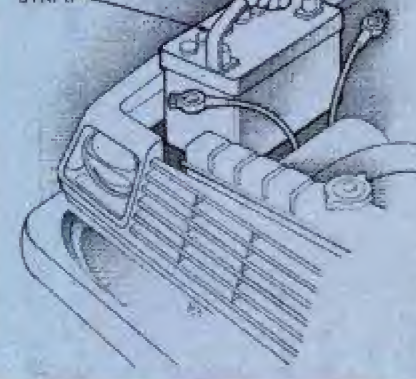
1. Have the idling speed and idling mixture adjustments rechecked as the engine is vibrating. Idle should be set between 750 and 950 rpm to give minimum dashboard vibration. It is normal for a Honda equipped with an automatic transmission to have a little dashboard vibration when idling in gear. However, it is not normal for the engine to idle at 450 rpm, which is much too low.

2. If the trouble is happening only with the air conditioner turned on, which I doubt (wouldn't you have said

(Please turn to page 24)

PM CAR CARE

TIP

LIFTING
STRAP

Bon voyage

Lots of people go on extended (30- to 60-day) winter vacations and leave their cars at home. The following steps will help protect the vehicle:

1. Add a six-ounce can of fuel detergent (conditioner) to the fuel tank for every five gallons of gasoline in the tank. Bounce the rear to mix the liquids and run the engine for five minutes at about 1,200 rpm to disperse detergent throughout the fuel system.

2. Remove the battery. Add water (only if it's a nonmaintenance-free battery) if necessary. Charge the battery and store it on a stand in a cool, dry place. Make certain that you don't store the battery in direct contact with concrete.

3. If the car is going to be left outdoors where the interior will be exposed to the sun's rays, tape some thin cardboard over the windows.

4. Inflate tires to the pressure embossed on sidewalls.

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CAR CLINIC

(Continued from page 22)

so?), have the air-conditioning idle boost on the carburetor linkage readjusted or replaced. This little vacuum-operated gadget is supposed to bring idling speed back to normal when the air conditioner is on.

3. If engine idle is fluctuating between 450 and 950 rpm during hot weather, then the fuel you use may be boiling in the carburetor float bowl. You may see bubbles in the sight glass on the side of the carburetor.

Run the engine until symptoms appear. Then, spray water over the intake manifold near the base of the carburetor for about five minutes. If the idle stabilizes, the test confirms that the fuel is highly volatile. Change your brand of fuel.

This particular problem is occurring with most makes of cars, because many brands of gasoline now contain alcohol, which is highly volatile. In many states, as long as gasoline does not contain 10 percent alcohol, there is no legal requirement for it to be labeled "gasohol." This means that the fuel you're using could contain as much as 9.9 percent alcohol.

The effects of alcohol on an engine were recently summed up by Chrysler

officials in a warning to dealers:

"Misblended fuels [Editor's note: defined as fuel blends containing excessive amounts of ethanol and/or methanol] can cause a number of serious problems. In general, driveability is poorer, fuel economy is lower, vehicle evaporative emissions are significantly higher and fuel system materials deteriorate prematurely."

Why would a fuel company add alcohol? To increase octane as cheaply as possible. The Internal Revenue Code allows companies a 4¢ per gallon tax exemption for alcohol-blended fuel.

Freeze-up in Fargo

I own a 1980 Plymouth Trail Duster that has a 360-cu.-in. engine. In late autumn and early spring, when the temperature hits 30° to 40° F. and humidity is fairly high, the engine develops a carburetor icing problem. I've replaced the Holley carb with a Carter and have experimented with bigger and smaller main jets. I've also examined intake ports. They are clear and outfitted with gaskets having correct orifices for cold weather.—Tim Gunnerson, Fargo, N.D.

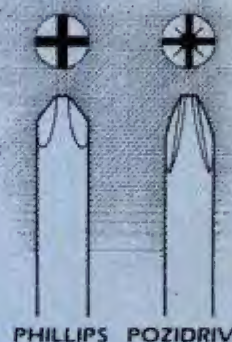
Has the heated-air intake system been removed from the carburetor? If so, reinstall it and check to see that the

"Pozi-tively" not Phillips

One is called Phillips; the other is called Pozidriv. Although they look similar, they're not. I'm talking about the screws that hold trim parts to newer cars. In the "olden" days, Phillips screws were used. Now they're Pozidriv screws, which provide better retention.

Believe me: You can't use a Phillips screwdriver to remove Pozidriv screws when doing a job like replacing a burned-out headlight. You need a Pozidriv driver, which you can buy at an auto parts and accessories store.

If you insist on using a Phillips screwdriver to do this type of work, you're going to screw up the screwheads without getting the screws loose.



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Yes, you can make \$1000 a month and more with just a hack saw in your spare time.

Will I Get Rich?

No, you will not get rich, but you can make over \$1000 a month in your spare time and have a ball doing it.

I tried all those "Get Rich" gimmicks that are advertised, that never tell you anything until you've sent them your \$25, and then you find out their gimmicks were not for you. Well, I've tried them all and I'm still not rich.

All I ever wanted was something I could do in my spare time with my hands, make a little money and enjoy myself and not have to buy \$3000 worth of tools or merchandise to do it.

Believe It Or Not

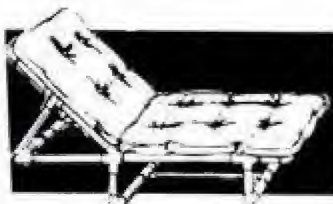
I found the most enjoyable and profitable business working with my hands and the only tools I use are a hack saw and measuring tape. The really nice thing about it is any man, woman or ten-year-old can do it.

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Just go look at some of this furniture in the stores and see some of the unbelievable prices it is selling for.

A chaise lounge that costs \$62.25 in material and three

hours of work is selling for over \$228 in the stores. I can sell my chaise lounge for anything I think my labor is worth. For once, the big manufacturing companies cannot compete with me or you on prices. You will find you will have more orders than you want!

Where can you buy the P.V.C. Pipe?

You can buy the P.V.C. pipe from any local hardware store to start. Plus I will supply you with the names and addresses of cushions and pipe manufacturers who will sell to you wholesale, plus I will supply you with my shop manual and six detailed shop drawings with pictures and measurements of six different designs.

Do you need my shop drawings?

No, you don't need my shop drawings unless you want to save hundreds of hours of trial and error work and thousands of dollars that I had to spend before I finally

found the right design and measurements and tricks to the manufacturing of P.V.C. pipe furniture. I only wish that when I started, I could have bought these shop drawings and I would have gladly paid \$100 for just one of them.

I will pay you!

Yes, I will pay you \$25 for any unique design shop drawing that I can use in my collection and workshop manual.

How do you start?

1) Decide if you like to work with your hands to create things and want to make money.

2) Can you afford \$12.00 for my shop manual and six drawings.

3) Send me your name and address along with your check for \$12.00 to:

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valve inside the air cleaner snorkel is functioning. Your carburetor should be equipped with this system, which prevents carburetor icing and improves cold driveability. If the air horn of the Carter carb has a different diameter than the original equipment Holley, you may have to modify the base of your original equipment air cleaner.

Use of the wrong intake manifold gaskets could cause driveability problems. Two different gaskets are used with 360-cu.-in. engines. One is for heavy-duty trucks, the other for light-duty trucks. It's possible that the wrong gasket was installed. The correct gaskets have part No. 3837605.

The use of a carburetor that is not the same as original equipment can cause problems. Cold start and warm-up driveability are greatly affected by slight variations in choke, fast idle and vacuum break calibration. Trying to adjust a nonstandard carb is a trial and error operation.

Insatiable appetite

My 1976 Ford, which has a 351-cu.-in. engine, eats ignition modules. The first was replaced in 1980. Since then, it's gobbled two more. Each time, a different brand was installed.—E.E. Brown, Raleigh, N.C.

The original Ford-made module installed in your car in 1976 had its circuit board and other components surrounded by sand. The sand was supposed to dissipate heat, but it wasn't always evenly distributed. Therefore, heat could get to the circuit board and destroy it, causing failure.

When Ford found out this was happening it changed the design. The new module is not as easily affected by heat. Some other parts manufacturers have been slow to act—that may be why you've been having trouble.

Furthermore, some cut-rate modules are built with modified (less expensive) circuits and inferior components. However, the modules produced by well-known suppliers of ignition parts should be at least the equivalent of the original equipment module. Some of the top-line aftermarket modules are guaranteed for five years or 50,000 miles, or longer.

To be sure you get a module that will last, buy it from a Ford dealer, or buy a nationally advertised, name-brand module with a guarantee. **PM**

DO YOU HAVE A CAR PROBLEM?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be discussed in the column.

SERVICE TIPS

- Before you tear down the 2.5- or 2.8-liter engine in your front-wheel-drive GM car because you think it has a bearing knock, check torque converter-to-flywheel bolts. Loose bolts sound much like bearing noise—that is, rapping as you accelerate.
- Is there an annoying front suspension "chuckling" noise when you drive a 1983 Chrysler K- or E-class car over bumps at low speeds? If so, install a new upper spring seat and damper assembly, one for each strut. It's No. 4052763.
- If your 1982-83 Escort, EXP, Lynx or LN7 suddenly starts losing coolant, look to the heater coolant tubes. The original tubes have a weak link—the welded joints where the mounting brackets fit. A new heater coolant tube (part No. E3FZ-18B402-A) is stronger.
- When you refill a drained cooling system of a Toyota 2T-C engine (Corolla, Carina), fill the radiator to the top. Then, unscrew the coolant temperature sending unit two turns. This bleeds air that's trapped in the cylinder head. The coolant level will drop. Tighten and add coolant. Don't start the engine as you do this.
- Don't be fooled into overfilling the crankcase of your 1983 GM 2.5-liter engine. Spot welds on the bracket holding the oil dipstick tube can keep the dipstick from seating. Replace the tube with part No. 10027337.

APPLIANCE CLINIC



Water on refrigerator

I have a General Electric refrigerator-freezer, Model TB14SLC. Three pools of water form on its top every three or four days. Why does this happen and what can I do about it?—Joseph D. Dimock, Ventura, Calif.

It sounds as if moisture has accumulated in the insulation around the top of the freezer compartment. Frozen, moisture-soaked insulation cools the metal cabinet top enough to condense humidity from the air and form the pools.

If you're lucky, the problem is caused

by not defrosting the freezer frequently or thoroughly enough to melt the ice on the inside as well as the outside of the evaporator. If you're unlucky, the freezer compartment liner is cracked.

Try defrosting the refrigerator and freezer completely. Transfer all food and unplug the unit. Let it warm up and dry out for 24 to 48 hours with the doors open. With luck, this will dry the insulation and solve your problem. If it doesn't, you may have to repair the liner or replace the insulation.

Appliances for the disabled

"The world of the disabled is frustrating enough without their home environment presenting extra difficulties that could be remedied with a little thought and ingenuity." This statement by Dr. Howard A. Rusk, founder of the recently renovated Horizon House, New York University Medical Center's Rehabilitation Center, inspired appliance modifications by Whirlpool.

Certain basic appliance designs have been identified as easier to use for the disabled. Minor changes in the controls make these units more convenient. While the ideas are generic, specific modifications apply only to Whirlpool appliances.

A soft vinyl adapter fits over the main control knobs on some Whirlpool appliances. Its larger size reduces turning effort and its soft surface lessens pressure on the fingers—important for arthritics. A simple hook-ended pusher-puller brings out oven grids so hot pots can be handled easier and safer from a wheelchair. Plastic faceplates with Braille markings enable the blind to operate microwave ovens and other appliances with finger-touch controls. An angled mirror over a stove lets a seated chef see into pots. Control-knob extension handles operate the rear-mounted stove controls.

Aids To Independent Living, an eight-page booklet on adapting and arranging appliances for the handicapped, is available free from Appliance Information Service, Whirlpool Corp., Administration Center, Benton Harbor, Mich. 49022.



Disabled consumers can use Whirlpool appliances more easily with modified controls. Vinyl adapter (top) for arthritics fits over standard knobs on Whirlpool's washer, dryer or dishwasher. Extension handle (middle) turns rear-mounted knobs from a sitting position. Brass rivets on oven controls (bottom) indicate positions in Braille to help blind or vision-impaired users.

Burning rubber smell

I have a Westinghouse two-speed washer, Model LA48OL, serial No. LWA16486. When I wash a load of clothes, it smells of burning rubber. Changing the belt twice helped, but only for a short while. The burned rubber smell soon returned. What do you think?—Norm Shisler, Kellogg, Idaho

Your problem could have several causes: 1, the idler pulley may be binding; 2, the transmission bearings could be worn enough to cause drag; 3, the drive belt may be incorrectly tensioned.

Remove the belt and try to turn the idler pulley by hand. It should spin freely. The transmission pulley should be tight and the shaft shouldn't wobble, but it may be too hard to turn easily by hand. Belt tension should allow a little less than 1/2-in. deflection between the pulleys.

You may have to call in the White-Westinghouse service people to find the source of the odor.

Humming ceiling fan

My newly installed ceiling fan from Moss Manufacturing Co., Model HF200, makes a very irritating hum when run at less than full speed. Turning down the rheostat from top rpm starts the hum in the motor. I've taken the rheostat apart and can find no sign of trouble. What would cause the motor to hum? It's a variable-speed job designed for 115 v. and rated for 50 to 150 rpm.—Yack C. Moseley, Huntsville, Tex.

I talked with Moss personnel in Florida. They believe your problem is in the speed control. The noise is coming from the control, but sounds as if it's coming from the motor. The only cure is to use a separate, wall-mounted control.

I suggest you contact the manufacturer by calling, toll free, 1-800-327-1516. Give them the model number and fan blade size and they'll send you the right speed control at no cost. **PM**

If you have a problem with any appliance, send your question, along with the model and serial numbers, to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.

9 mg. "tar", 0.7 mg. nicotine av. per cigarette by FTC method.

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Warning: The Surgeon General Has Determined
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**I know where the gas goes.
And that's all I care to know.**



Mr. Goodwrench knows how to keep my car running right.



Heaven knows I'm no expert on cars. But I get along pretty well. All I do is follow the maintenance schedule in my GM owner's manual. I go to Mr. Goodwrench for regular service and for advice I feel I can trust. Thoroughly.

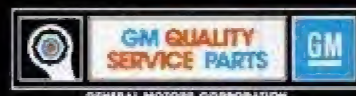
You see, Mr. Goodwrench has the right tools and equipment. And he has GM training available. Besides that, he can get genuine GM parts—the kind engineered just for my General Motors car.

And Mr. Goodwrench is committed to reasonable prices—he has pledged to be competitive with other places I can go around here for service. To me, that's important.

So keep that great GM feeling with genuine GM parts at participating independent Mr. Goodwrench dealers selling Chevrolets, Pontiacs, Oldsmobiles, Buicks, Cadillacs, GMC and Chevy Trucks.

LET'S GET IT TOGETHER...BUCKLE UP.

Mr. Goodwrench



HOMEOWNERS' CLINIC



Moisture on bathroom walls

Our bathroom walls are drywall. Although we've used many coats of primer on the area, the paint on 2 ft. of wall above the shower tile keeps blistering. We realize it's a moisture problem, but a fan or open window are impractical. Is there a special paint or preparation we can use to prevent this?—Constance O'Keefe, Canton, Mich.

I guess you know that without a fan or operable window, you're courting trouble. However, if you can ever get

the blistered area dry enough to work on, I believe that the next best thing to ceramic tile would be to sand the old blistered paint thoroughly and cover the area with a solid vinyl wall covering (not vinyl-coated wallpaper).

When you apply the vinyl wall covering, make sure you brush the top and bottom edges and all joints tightly against the wall. This will prevent moisture from entering behind the covering and loosening it.

Painting Styrofoam

Can you tell me what kind of paint I can use to paint Styrofoam without damaging the material? I have several Styrofoam ice chests that we use when traveling. They're getting very soiled, but new chests aren't available in the size I want.—P.J. Lindsay, Stuttgart, Ark.

Your cooler may be made by one of many manufacturers of polystyrene. Styrofoam is the trade name of one made by Dow Chemical U.S.A., and is probably the best known. You can paint polystyrene with any latex (water-soluble) paint. Solvents in oil-base paint might harm polystyrene.

Concrete cleaners

Recently, I tested two concrete and masonry cleaners by Vi-Chem Products Inc., Box 34507, San Antonio, Tex. 78265-4507. All I can say is don't use these products unless you plan on cleaning your entire driveway. They do such a great job of cleaning that if you only clean the grimy spots, you'll have a speckled, clean-dirty surface.

Rust-X contains a trace of oxalic acid and is designed specifically for removing rust stains from masonry and concrete without etching the surface. However, the maker claims that it works just as well on other surfaces, such as painted metal, fiberglass and vinyl.

A companion product, Scrub-it, removes dirt and grime from concrete surfaces. The manufacturer also recommends it for cleaning asphalt and ceramic tiles. I used Scrub-it on my ceramic-tiled shower pan. It removed old soap and grime quickly and effortlessly. As the manufacturer claims, I can see no damage to the tiles.

Vi-Chem publishes a Hotline brochure which includes descriptions and prices of all the company's products. To receive the brochure, send a stamped, self-addressed envelope.

In the South and Southwest, the products are available through the Handy-Dan and Handy City chain. If you live in other areas, you can order by mail. A 22-ounce bottle of Rust-X costs \$4.99 and the 1-gallon size is \$15. The 28-ounce container of Scrub-it Patio & Drive Cleaner costs \$3.69. Send a check or money order and include \$2.50 for sales tax and shipping.



A great combination for cleaning a concrete drive or patio (top): Rust-X removes rust from concrete and masonry without etching the surface. Scrub-it gets rid of dirt and grime from concrete surfaces. Pour a small amount of Rust-X on a stain and lightly brush it (middle). After 5 to 10 minutes, you should rinse the area thoroughly with water to clean the spot (bottom).

Attic ventilation

I am considering installing an electric attic fan in my roof. I've been told that because I only have small openings in the gable ends of my house, I'll need more venting holes for the fan to work properly. How much venting is needed for the turbine vents which are turned by the wind? Perhaps these are a better solution to my problem.—W.A. Swanson, Oak Lawn, Ill.

The FHA Minimum Property Standards require that $\frac{1}{50}$ of the ceiling area be free ventilating area. A 20 x 30-ft. ceiling equals 600 sq. ft. Multiplied by $\frac{1}{50}$, that equals 4 sq. ft. of vents. You can reduce this to $\frac{1}{300}$ of the ceiling area if 50 percent of the ventilators are in the upper portion of the roof. They must be at least 3 ft. above the eave or cornice vents.

You can also reduce the square footage of vents required to $\frac{1}{300}$ of the ceiling area if there is a vapor barrier not exceeding one perm (the rating for the ability of a material to deter the passage of moisture) on the warm side of the ceiling. I would stick to the $\frac{1}{50}$ (more venting), in any case. An electrically powered fan will, of course, move air quicker than a wind turbine. **PM**

Do you have a home-maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in the column. For more home-repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send your order(s) to Popular Mechanics, Box 1014, Radio City Station, New York, N.Y. 10101.

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NEW WAY
TO MAKE
SPORTS COUPES
PERFORM.



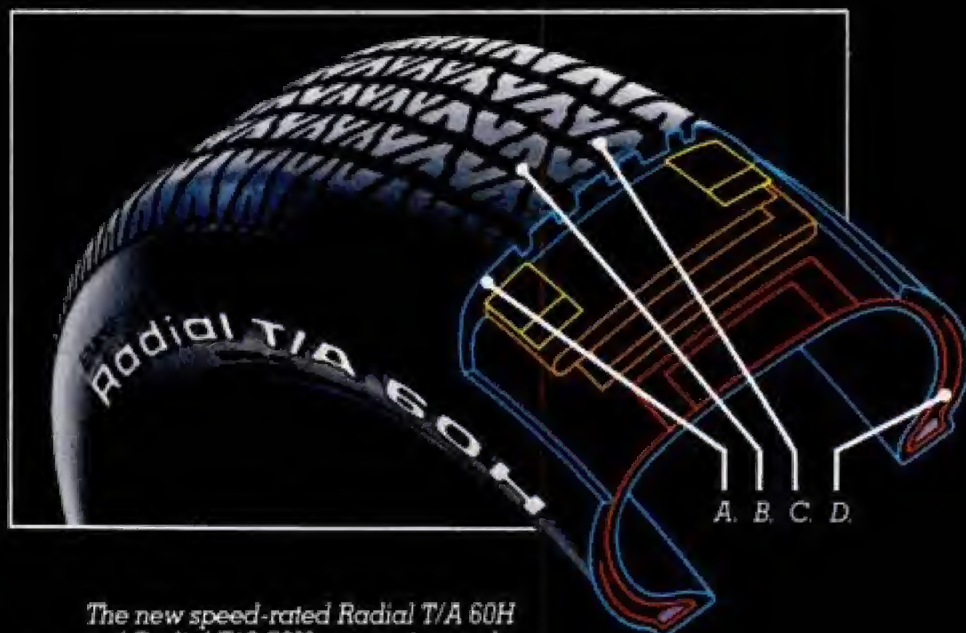
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SIZE AVAILABILITIES AND ENGINEERING DATA:

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TIRE SIZE	BF GOODRICH RECOMMENDED RIM WIDTH RANGE	INFLATED DIMENSIONS @ 28psi			REV/MI @ 45 MPH	MAXIMUM LOAD (lb) AND INFLATION (36 psi)
		OVERALL DIAMETER (inches)	TREAD WIDTH (inches)	SECTION WIDTH ON MEASURING RIM WIDTH (inches) (inches)		
205/60HR13	5.5- 8.0	22.68	6.20	8.19 on 6.0 rim	903	1160
195/60HR14	5.0- 7.5	23.23	5.76	7.80 on 6.0 rim	886	1210
215/60HR14	5.5- 8.5	24.17	6.54	8.50 on 6.0 rim	859	1365
235/60HR14	6.0- 9.0	25.12	7.11	9.45 on 7.0 rim	830	1580
205/60HR15	5.5- 8.0	24.69	6.20	8.19 on 6.0 rim	843	1365
235/60HR15	6.0- 9.0	26.10	7.11	9.45 on 7.0 rim	801	1630
255/60HR15	6.5-10.0	27.05	7.77	10.05 on 7.0 rim	773	1890

RADIAL T/A 70H

TIRE SIZE	BF GOODRICH RECOMMENDED RIM WIDTH RANGE	INFLATED DIMENSIONS @ 28psi			REV/MI @ 45 MPH	MAXIMUM LOAD (lb) AND INFLATION (36 psi)
		OVERALL DIAMETER (inches)	TREAD WIDTH (inches)	SECTION WIDTH ON MEASURING RIM WIDTH (inches) (inches)		
175/70HR13	4.5-6.5	22.83	5.06	6.92 on 5.0 rim	899	1025
185/70HR13	5.0-7.0	23.54	5.47	7.31 on 5.0 rim	877	1140
185/70HR14	5.0-7.0	24.57	5.47	7.31 on 5.0 rim	847	1210
195/70HR14	5.0-7.0	25.04	5.70	7.74 on 5.5 rim	833	1340
205/70HR14	5.5-7.5	25.67	6.08	8.10 on 5.5 rim	814	1490
225/70HR15	6.0-8.5	27.40	6.43	8.65 on 6.0 rim	763	1730

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RADIALS

THE PM GARAGE

Vacuum-pressure gauge option



Mytyvac vacuum gauge can be used to test vacuum- and pressure-operated hardware.

The Mytyvac manual vacuum pump is one of the handiest in a modern mechanic's toolbox. It's used to test various vacuum-operated engine controls. Some owners bought only the pump, made for brake bleeding, which has no vacuum gauge. If you have one, you can now add a vacuum-pressure gauge for under \$15, so that you can use the pump not only to check vacu-

um-operated hardware, but such low-pressure items as a turbo wastegate, which is typically triggered by 7 to 10 p.s.i. If you have a pump with a pressure gauge, you can add the new vacuum-pressure gauge. The gauge is at auto parts stores that sell Mytyvac pumps. For more information, write to Neward Enterprises, Box 725, Cucamonga, Calif. 91730.—Paul Weissler

Power windows



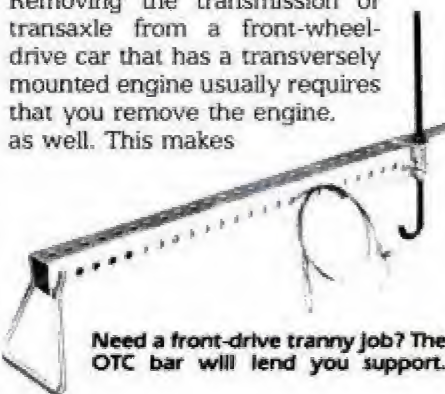
Electric window winder mounts on the door trim panel and does the grunt work.

Does winding up windows get you down? Mitsubishi's do-it-yourself power windows are easy to install. The units are surface-mounted by brackets. A special three-pronged expandable joint, available in four different designs to fit most cars, connects the unit's motor shaft firmly to your car's window-winder mechanism. A built-in torque limiter device stops the window

if the glass makes contact with any obstacle. The unit measures $4\frac{3}{4} \times 2 \times 7\frac{1}{2}$ in. and weighs 2.7 pounds. You can buy the units at car audio dealers for a list price of \$129.95. They're distributed by Mitsubishi Electric Sales America, 799 North Bierman Circle, Mount Prospect, Ill. 60056.—M.L.

Fwd engine hoister

Removing the transmission or transaxle from a front-wheel-drive car that has a transversely mounted engine usually requires that you remove the engine, as well. This makes



Need a front-drive tranny job? The OTC bar will lend you support.

Air sniffer tester

If you have a late-model car with an oxygen sensor, you need a way to check it out. If the sensor or its feedback fuel system fails, engine performance will be affected.

Many testers are available, but most are expensive and limited to certain makes. This tester costs about \$55 and will work on most cars. It has a light that flashes when the oxygen sensor is operating normally. It also has a switch that will simulate rich or lean signals from the sensor to the fuel system. The engine should speed up or slow down when this switch is used, allowing you to check out not only the sensor, but the systems that it operates. It's made by Thexton Mfg. Co., Box 35008, Minneapolis, Minn. 55435, and is sold at most auto parts stores.—Paul Weissler



You may need an oxygen sensor tester to track down any rough running problems.

even a clutch replacement a major job. The OTC Model 1722 universal support bar holds the engine in the car while you remove drive-line components.

The support bar rests in the fender channels and holds the engine with $\frac{1}{8}$ -in. braided steel cable and a 14-in. hook. The 14-pound bar supports 500 pounds and telescopes to 52 in. wide. It's \$129 at parts stores from Tools & Equipment Div. of Owatonna Tool Co., 873 Eisenhower Dr., Owatonna, Minn. 55060.—M.L.

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DELIVERED (INCLUDES TAX)
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OUR 27th YEAR

- Ends broken handles, stuck axes and flying wedges.
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- Drop 'em, saw 'em, stand 'em up and split 'em.
- No gimmicks, just simple physics.

GUARANTEED 10 YEARS AGAINST FAILURE

For many years, you've seen our ads and read unsolicited letters from folks just like you, saying how unbelievably effective the Monster Maul really is. Try a **MONSTER MAUL AT OUR RISK!** Within one year, if you don't think it's the fastest, least tiring method of splitting firewood, let us know, and we will give you your money back, including shipping... plus it's guaranteed against failure for 10 years.

Weight: (Total weight 15 lb.)

Price: **\$19.94** Factory pickup.

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NEIGHBORLY LESSON

I visited my neighbor last week to find his son and son-in-law struggling to lift heavy cross-sections of oak and hickory onto a tractor-powered hydraulic splitter. I pulled the Monster Maul out of the back of my pickup and went to work. After 15 minutes with aching backs, they and their 80 hp fuel-eating rig had split about 2/3 of what I and the Monster had, and I was just getting loosened up. The first question they asked was where they could buy such a maul.

Bill Dieckman, Letts, IA

MONSTERCIZE

I recently ordered the Monster Maul, after having decided that, with your guarantee, I couldn't lose. I am thoroughly delighted. I am impressed with the quality of construction and the simple, purely functional design. I also find that wood splitting has become my evening exercise. Now I've got all those other splitting tools left to collect dust. I am ordering a set of woodstove tools. (Do you know how long I've looked for a rake?), and a Maul for my father's birthday. It's nice to find a company that makes simple, straightforward products that are designed to be used.

Doug Allison, Atlanta, GA

UNDOUBTEDLY THE BEST!

I have one of your Monster Mauls and it's the greatest splitter I have ever used. I split 3 cords of oak in 1 day; approximately 2 hours per cord. The oak was 16"x 18" and the maul split it with ease in just one and two shots. Enclosed is \$15.95 for a set of your woodstove tools. I have no doubts that it will be as good a product as your monster maul. Thank you for prompt delivery. P.S. Please send me one of your up-to-date newspapers, I really enjoy reading it. Thanks.

Louis A. Colasante, Hatboro, PA

ADD "UMPH" TO YOUR SWING!

Just a few lines to tell you how pleased I am with your Monster Maul. I purchased your 15 lb. about 2 months ago, and have since split at least 5 cords of firewood, mostly red oak and elm. The extra weight (as compared to conventional splitting mauls) handles very easily and adds extra UMPH to your swing! It is very well balanced, durable, and makes wood-splitting almost fun! My father has an 8 lb. splitting maul with a conventional wooden handle and has had to buy at least 3 replacement handles in the last couple years. Your all steel handle makes the occasional over strike much less expensive, and handle replacement a thing of the past. I'm not denying that I've gotten hung up a few times when splitting elm, since elm is such a stringy wood. But the oak splits first swing every time, even the biggest blocks.

William Coolidge, III, Jay, NY

NO PROBLEMS

I bought a Monster Maul about two years ago and it's all that you say it is and then some. At first I thought it might be too heavy for me (I'm 69 yrs. old) but it's no problem. No effort at all to use. Saves handles too. P.S. I'm ordering this one for my son-in-law for Christmas.

Vernon Korpi, New Ipswich, NH

SENSAPHONE.

A TECHNOLOGICAL BREAKTHROUGH IN HOME AND OFFICE PROTECTION

WHAT IS SENSAPHONE?

Sensaphone is a home and office security system. It will call you in the event of fire or break-ins. Sensaphone allows you to listen in to "live" sounds in your home or office while you are away. It will alert you in case of electrical failure...if the room temperature goes up or drops excessively...even if your basement floods. And Sensaphone is also an automatic phone dialer.

MONITORS ENVIRONMENTAL CONDITIONS

Connected to your telephone, the Sensaphone checks for power failures, monitors the temperature in your home or office, listens for any unusual sounds and three conditions of your choice when used with our optional accessories. If the temperature rises, if the power falls or your smoke alarm goes off...Sensaphone will tell you.

INSTANT TWO-WAY COMMUNICATION

The Sensaphone is so intelligent it speaks to you. This compact, easy-to-use unit identifies itself in plain English, gives the correct time, the room temperature, if the electricity is on and then lets you listen in through its built-in microphone. Even if your power fails, the Sensaphone assures full operation and memory retention with its own battery back-up system. The Sensaphone will call the preprogrammed numbers to warn you the power is off or if its battery power is low.

HEAR "LIVE" SOUNDS

Whether traveling, out for the evening or just checking on your vacation home, you can call from any phone in the world and check the status of all conditions. The Sensaphone will answer with a "hello" and your telephone number. All six conditions will be accurately reported and then you can listen for noise. An excellent way to listen in on the kids when you're away or for unusual sounds in your home or office.

AUTOMATIC DIALER

You can also use the Sensaphone as an automatic dialer when you're at home. Easily program eight of your most frequently used numbers (up to 16 digits long). Press the dial key, and your Sensaphone will automatically dial the number you want.

EASY INSTALLATION

Even installing the Sensaphone is easy and takes only a few seconds. Programming takes just a few minutes and you can continue to use your phone in the normal manner. Installation of the Sensaphone may entitle you to an insurance discount of up to 10 percent. (The Aetna Casualty and Surety Co. now offers 8% when used with a smoke detector.) Contact your insurance agent for details. Fire, electrical failure, break-in, flooded basement, excessive cold or heat, Sensaphone calls you the minute it happens.

Dimensions: 7 1/4" x 2" x 8 1/2"

Three accessory sensors are available separately for the Sensaphone: a magnetic reed switch which can be installed on doors, windows, drawers or anything that opens or closes. A water level switch for any area (such as your basement) where water damage could occur and a remote temperature sensor allowing you to monitor the temperature at a remote location.

Now you can protect your home, your vacation house or the security of your office with a Sensaphone, a product of Gulf & Western, made in U.S.A. Next to your home, the Sensaphone could be the most important investment you make.

WE ABSOLUTELY GUARANTEE!

Use the Sensaphone with your home or office phone (or both) for up to 30 days. If you decide for any reason you are not satisfied, return for a 100% refund.

SB1000	\$239.95
or \$225.00 each for two or more units	
SB0011 (Magnetic Reed Switch)	\$ 10.95 each
SB0012 (Water Level Switch)	\$ 39.95 each
SB0021 (Remote Temperature Sensor)	\$ 19.95 each
(ADD \$5.50 per order for shipping)	

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ALL OUTDOORS



Better boots and bindings

Fumbling with an ice-stuck lever to latch the toe-string of your cross-country ski boot can be as irksome as



Cross-country ski boots and bindings don't pinch toes. Boot groove improves control.

pinched toes from the boot flexing as you ski. Now, a new step-in binding, the Salomon Nordic System (SNS), features a flex plate to transfer the flexing from the boot to the binding. Skiers can take longer, more comfortable strides without being bitten by their boots.

The new binding also mates the SNS boot sole groove to the raised ridge on the binding, giving more precise ski control. A molded Zytel toe housing extends reinforced toe rings to improve lateral control, as well. This feature can be vital to World Cup and World Loppet racers, but it also makes a very real difference for recreational touring skiers or first-time renters.

To step into the SR Automatic binding, press down on the Delrin fitting and engage the toe ring. You can unlatch the fitting with a ski pole or by stepping on it with the other boot.

Salomon boots and bindings are available from Salomon/North America Inc., 7 Dearborn Rd., Peabody, Mass. 01960.

Welcome on board

The U.S. Supreme Court ruled recently that boaters in coastal waters have no constitutional rights against completely random searches and seizures.

In *U.S. v. Villamonte-Marquez*, crew members of the sailboat *Henry Morgan II* were found guilty of possessing drugs. Their boat was boarded near New Orleans by U.S. Customs officials and Louisiana state police officers for a routine document inspection. The officers found marijuana. A U.S. district court imposed the guilty verdict, which was reversed by an appeals court on the grounds that the boat was boarded without "reasonable suspicion of a law violation." The Supreme Court reimposed the guilty verdict.

Justice William Rehnquist said the boarding was legal and reasonable, citing a 1790 law. Dissenting, Justice William Brennan wrote that for the first time in 200 years, the Supreme Court swept aside the "quite reasonable expectation that the occupant was entitled to remain undisturbed by arbitrary government authority." Now, your boat is subject to inspections without reasonable suspicion of a violation.

Now: Walk on water!

You don't always need a boat when you go out on the water. Here's a new set of skis that'll let you walk.

Inflatable Walk On Waterskis are soft PVC pontoons. They are 92 inches long, for people weighing under 160 pounds, or 102 inches long, for those over 160. Each ski has an 8-inch beam, aluminum tube keel and an 11-inch stabilizing skeg like a surfboard. The skeg retracts so you can walk out of the water onto the shore.

Cone-shaped pockets on the bottom of each ski catch the water as you push back and collapse to let you slide forward easily. Kick cups under the feet and aft-mounted scoops increase traction. Bag-shaped floats on ski poles also have traction cups.

Walk On Waterskis go anywhere in calm water, but are not for windy days. Their suggested retail price is \$185 from CMI Leisure Products, 5353 Wilcox Rd., Montague, Mich. 49437. **PM**



Inflatable Walk On Waterskis are soft PVC pontoons that can go anywhere in calm water.



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pair of \$55 Wolverine genuine pigskin leather boots, for just \$3 postage and handling! Your Homelite dealer will give you details, and then he'll show you even more features, to boot.

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It's not enough just being the leader in 2-cycle engine technology and pioneer of the modern chain saw. Our latest engineering breakthroughs result in the most advanced performance features imaginable! Features like advanced carburetor design on our updated Model 410, for improved engine idle and acceleration. Extended wear features



that let our new Model 245 go above and beyond the call of medium duty saws! Combine that with features like vibration isolation for more control and less fatigue, and you've got the best selling line of chain saws in America today!

We're America's #1 chain saw because safety is our #1 priority.

Homelite chain saws continue to set an example for the industry, with safety features unheard of on other saws. Our exclusive SAFE-T-TIP® anti-kickback device totally eliminates kickback by preventing the nose of the guide bar from striking a solid object. And our Raker III™ Kickback Suppression Chain reduces kickback intensity by as much as 75% compared to conventional non-safety saw chains.

With so many features, you've got all the right reasons for walking away with a brand new Homelite chain saw. And with our FREE boot offer, you'll even get something to walk away in!

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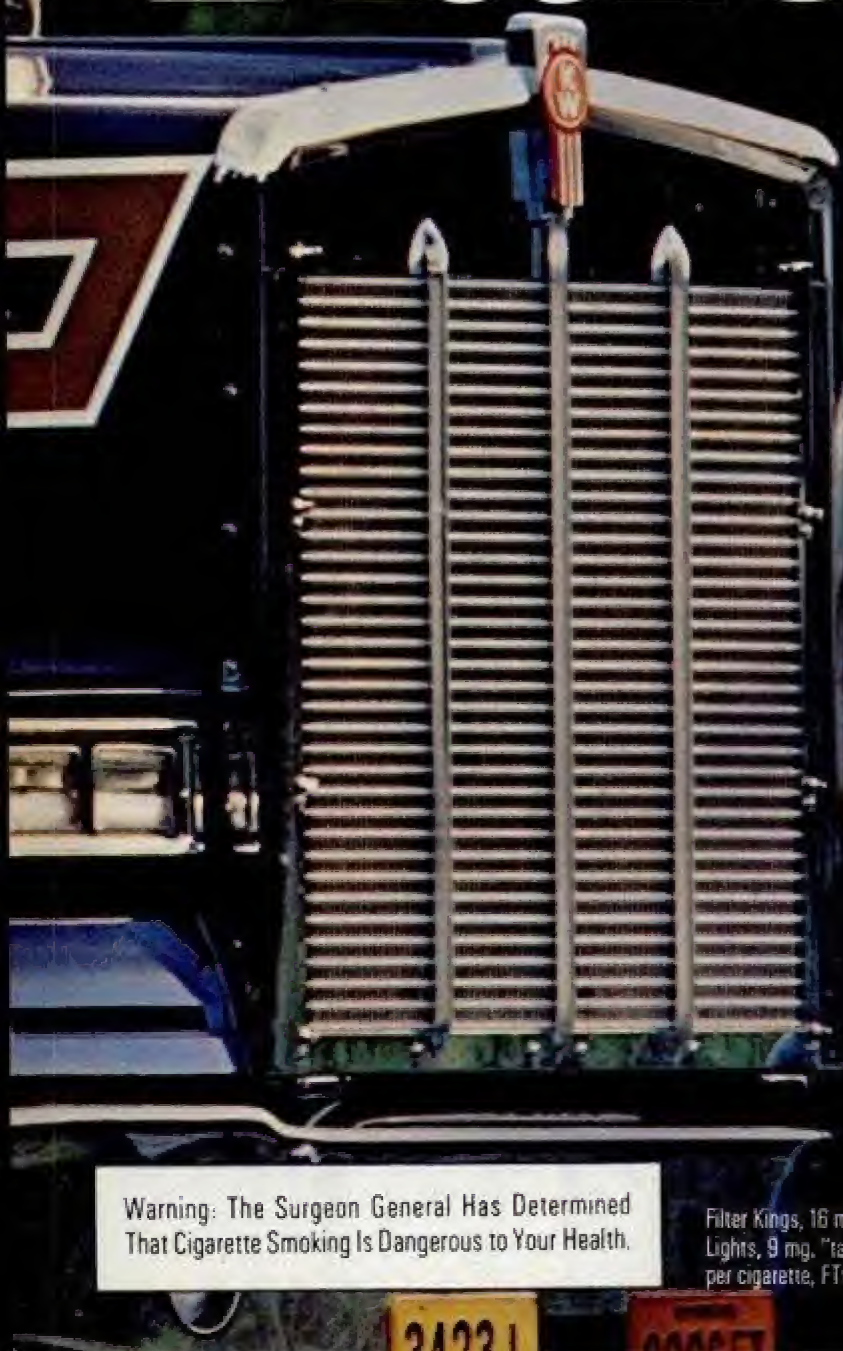
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per cigarette, FTC Report Mar. '83.

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IMPORTS & MOTORSPORTS



Redesigned Honda Civics for '84



CRX two-seater hatchback coupe is the EPA economy champ and new Civic model for '84.

The CRX may be brand-new, but it looks like it was already hit from behind. Coupe owners will need a smart answer for "Where's the rest of your car?" It's the most unusual model in the '84 Civic line, and the one that holds the EPA's top honors: 51 mpg (67 highway). The gas-engined CRX knocked the diesel Rabbit, the former economy champ, right on its tail. Truncated, but cute, the coupe is a two-passenger, no-back-seat hatchback. With

its 1.3-liter CVCC Four engine and five-speed, it's the line's most economical model, replacing the FE of last year. The CRX is also available with the 1.5-liter, 12-valve Four, which nets 36 mpg (49 highway) with five-speed.

Civics with back seats, the redesigned four-door station wagons, sedans and two-door hatchbacks, get some new twists for '84. Most have a split rear seatback, of

course, but these back seats recline and are on tracks for back-and-forth adjustments. Inside and out, the redesign of the Civic makes it very individual—except, perhaps, the station wagon model. The station wagon resembles Toyota's 4wd because it copies that wagon's aft side window, dipping below the belt line and cutting high into the roof.

The third-generation Civics—with the addition of the sporty, yet frugal, CRX coupe—constitute a more formidable presence in the market than ever before. They continue to set the standard for all minis.



Civic Hatchbacks get a station-wagon appearance from their long-roof-line design.



Suzuki Cultus could be sold here as the 1985 Chevrolet Sprint if the GM plan unfolds.

Chevy come lately

Can this car give the Civic a run for the money? It's not bad-looking, and it may be an '85 model. The mini is on sale in Japan right now as the Suzuki Cultus. What's it gonna be here? Would you believe the Chevrolet Sprint? That, indeed, is General Motors' plan. GM owns a piece of Suzuki and would like to sell the three-cylinder hatchback through its

Chevy dealers. In price and fuel economy, it would have the edge on Honda's Civics, but we wonder if it's got the, well, charisma. It certainly won't have the performance, not if the one-liter Three remains the powerplant.

There are a lot of "ifs" attached, not the least being voluntary restraints. If an increase in the import level of 1.68 million Japanese cars is not allowed next year, we may not be doing a road test of this one.

A Rabbit, obviously

Since the new Rabbit is already on sale in Europe (where it's called the VW Golf), you may wonder why you've never seen artist's concepts or sneak photos in PM. Well, we had them, but couldn't believe that the advance drawings and photos of the second-generation Rabbit were accurate. Surely we were looking at a mule, an old Rabbit with a piece grafted in the middle to make it longer. But, it turns out that the fuzzy pics we saw were exactly right.

Now that we're seeing sharp photos of the car in its production metal, it's looking a lot better. Quite nice, in fact. The external differences from the original Rabbit are subtle (like BMW's 320i redo). Inside and underneath, however, VW claims everything is *besser*. We'll have time to check this everything-is-better claim since we're sure to drive the new Golf before it arrives in the United States as the '85 Rabbit.

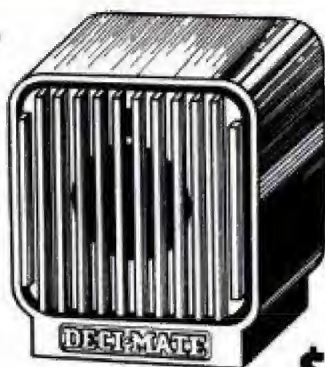


Hindquarter of the '85 Rabbit will be the part most different from the current model.

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Ants, rats, mice, roaches, fleas, bats, spiders, etc. etc. What a pain they can be! You can fumigate them, poison them, trap them, etc. But what do you do with those dead and unsightly things? And those poisons can be harmful to humans and pets. Bentley's knows a better way! DECIMATE delivers an ultrasonic sound that cannot be heard by humans or pets. It is completely harmless. But it is another story to all those pests and varmints. It drives them looney! DECIMATE causes them extreme discomfort and pain. Would you take this kind of treatment? Heck no. And neither will they. In just a few weeks all those pests and varmints just leave and never come back.

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HINTS FROM READERS

Magnifier finds faults



After hastily buying a backsaw and discovering that it was almost unable to cut fir plywood, I decided that a magnifying glass should always be used to select edged tools in a store. Although I always carry a pocket magnifier, I didn't take the time to use it in this case. The teeth felt sharp to the touch. Trying to cut plywood, I examined the saw with the magnifier and discovered that most of the teeth had rounded points instead of sharp ones. The saw showed no signs of having been used before I bought it. The teeth probably had been damaged by careless handling, or by being hit against something hard. Pocket magnifiers with protective covers are readily available. You can also use a lens from an old camera.—Walter E. Burton

Locating dowel holes

It's easy to locate dowel holes with the aid of carbon paper and small, split-shot fish sinkers or BB shot. Place the pieces to be doweled on a flat surface, fold a piece of carbon paper with the carbon side out and place the shot in the fold. Position this between the workpieces, tap lightly with a hammer and both pieces will be marked at mating points. The light tap causes the carbon to mark the work where the shot touches, yet it won't mark elsewhere.—Howard E. Moody

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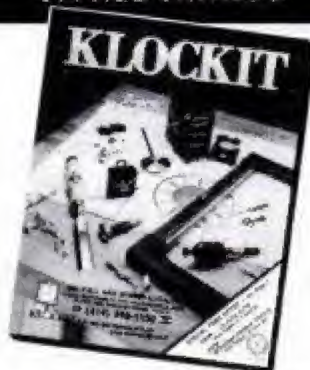


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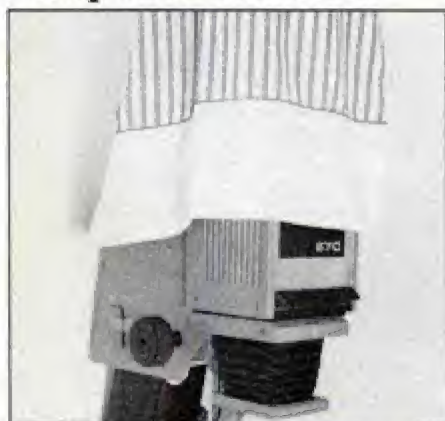
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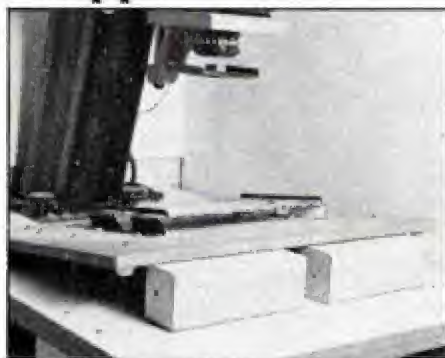
PM PHOTO HINTS

Ready-made dust cover



Enlargers are often subject to problems with dust. An old pillowcase is excellent for covering the top of the enlarger.—Robert Hertzberg

Tricky pix



Startling distortion effects can be produced in many enlargements by raising the easel at one end with wood blocks.—Robert Hertzberg

Safe spares



Extra flash batteries should not tumble loose in your gadget bag. A few AA-size batteries will fit into a 35-mm film container.—Robert Hertzberg

Discover the world's oldest hobby!

Build this beautiful wooden ship model.

*Special offer for
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ship before!*

Wouldn't you love to build this historic ship model? It's a true-to-scale, 21" replica of the 2-masted schooner *Swift*, a Virginia pilot boat of 1805. Well, now you can! And you don't have to be a skilled craftsman to do so.

It really isn't hard

Even if you've never built a model before, you can experience the relaxing pleasure and pride of accomplishment that is offered by this fascinating hobby. You can build the *Swift*. The secret's in our kit, designed especially for the first time modeler, with pre-cut parts that make assembly easy. Clear, large scale plans and instructions that virtually take you by the hand and guide you every step of the way through hours of the most relaxing fun you'll ever have. And when completed—a museum quality model you'll display with pride, with gleaming brass fittings, walnut planked hull, delicate rigging—lifelike in every detail.

Quality you can see and feel

The materials in our kit may be better than those used in the original *Swift*. The keel section and frames are pre-cut plywood, ready for quick assembly. The *Swift's* hull is planked twice; once with thick, flexible limewood for strength, then overlaid with planks of African walnut for lasting beauty.

You won't have to make the fittings—we've done that for you. Our kit contains ready-to-use blocks and deadeyes of rare, yellow boxwood. We include eyelets, bracers and belaying pins—over 70 parts of solid brass! Even the cabin door hinges are brass, as are the 250 miniature nails you'll use to fasten the plank-

ing to the hull and deck. And, since the original wooden *Swift* had no plastic parts, our kit doesn't either—anywhere!

Creative? And how! Overwhelming? Not a bit! But be prepared for hours of the most challenging, engrossing, relaxing fun you've ever had.

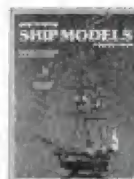
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Our special offer includes the *Swift* kit plus all the tools you'll need to build her: miniature pliers, hammer, knife, file, tweezers, sandpaper, glue, wood oil, and more. You'll also receive a free copy of Richard Mansir's "How to Build Ship Models," a 64-page beginner's guide. You don't have to buy anything else. The tools normally cost \$15; the book retails for \$7.95. But they're yours, FREE when you buy the *Swift* kit at its regular price of \$39.95 (plus \$4 handling and insured delivery).

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More about power planes

While it's no secret that power planes can make short work out of many planing tasks, they can also cause a great deal of trouble if they are not used properly. The two most common mistakes are shown in the photos at right—namely, improper tool alignment when starting and finishing cuts. The best way to avoid these mistakes is to spend some time practicing on a variety of scrap wood before you put the tool to any finish work.

Tool alignment is particularly crucial when planing the end grain of stock because the edge is normally quite short. To do this properly, hold the tool as shown in the photos and make a short pass in one direction—about 1 in. into the stock—then finish the cut from the other direction. The two cuts should meet flush, thus keeping you from splitting off any stock when you come to the long edge of the board.

Don't assume that power planes are designed only for edge planing. These tools can be used for surface planing, as well. Just keep in mind that scant stock removal is the best policy. If you have the cutter set too deep, these powerful tools can make severe gouges in a surface, almost before you know it's happening. It's a better idea to make several shallow cuts until the surface is flat.

Another great use for the power plane is to cut rabbets along a board edge. To do this, you must have a planer equipped with a fence which functions in much the same way that a rip guide operates on a circular saw. By adjusting this fence in and out, you can regulate how far across the board the cutter will extend and, therefore, the width of the rabbet. The depth adjustment on the tool itself regulates the depth of the rabbet.

In the final analysis, the most important power planing techniques are safety oriented. Remember that the 3-in.-wide cutter is completely exposed when it is operating; there is no protective guard. And, never touch or remove the cutter unless the tool has been unplugged. These tools can become extremely hot during prolonged work sessions, so let them cool periodically. **PM**



A well-maintained power plane, with its supersharp cutter, allows for fast removal of large amounts of edge stock. The tool can also be used to remove surface stock.



It's crucial that the plane be positioned properly before starting. It should rest flat on the board edge, as shown here, with the cutter not yet touching the wood.



This exaggerated pose shows the wrong way to start a planing pass. But even if the back of the tool is just slightly lower than the leading edge, you will get a pronounced dip at the beginning of the cut.



Top board shows scoop that results from dropping rear of plane at beginning of cut. Bottom piece shows edge planed properly.



Maintaining the same flat tool alignment is equally important at the other end of a planing pass. Make certain that the tool remains level until the cutter has moved completely clear of the board's edge.



Again, the photo shows an exaggerated dip at the end of a cut. Be sure to watch for this tendency until you master the tool.



If you do permit the front of the blade to dip as it leaves the edge of the stock, you will get a gouge like the one above.



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0451	FORD PICK-UP 69-83 all 2 whl dr 7-series & diesel	\$12.95
8204	FORD VANS 61-68 for all 1/2, 3/4, & 1 ton models	\$10.95
0453	FORD VANS 69-82 covers all 6 & 8 cylinder models	\$12.95
9436	GRANADA, FORD 75-82 covers all models	\$10.95
8848	HONDA ACCORD CIVIC 76-82 covers all models	\$12.95
9787	HONDA PRELUDE 79-82	\$12.95
8694	HONDA CIVIC 73-81 covers all models inc. Civic	\$10.95
8206	INTERNATIONAL SCOUT 67 73 800, A, B, 8 mtds	\$10.95
8565	INTERNATIONAL 62-80 tune/maintain Scout, wagon, pick-up	\$10.95
1043	JAGUAR E-TYPE 61-72 covers all 6-cylinder models	\$12.95
9612	JAGUAR E-TYPE V12 71-74 covers all models	\$12.95
9399	JAGUAR XJ6 68-79 covers all models	\$12.95
9617	JAGUAR XJ12 72-80 for all models inc. XJS, Daimler	\$12.95
9769	JEEP, WILLYS 50-65 all 4 & 6 cyl station wagon, pick-ups	\$12.95
8207	JEEP 66-79 for all Cherokee, Commando & Wagoneer mtds	\$10.95

9805	JEEP WAGONER J-series with 230 cci eng	\$19.95
9806	JEEP UNIVERSAL CJ-2, CJ-3 report factory manual	\$19.95
8155	JEEP CJ 68-81 covers all CJ-5, CJ-6 & CJ-7 models	\$12.95
0596	LANCIA BETA 76-80 for sedan, coupe & V6 models	\$13.95
1254	LANDROVER 59-77 covers 2, 3A, 3 gas & diesel models	\$12.95
0481	MAVERICK 68-71 6 cyl, 170, 200, 250 cu in eng	\$10.95
8211	MAVERICK 72-77 covers all models	\$10.95
1550	MAZDA GLC 77-82 for all rear wheel drive models	\$12.95
0812	MAZDA GLC 81-82 covers front wheel drive models only	\$12.95
0444	MAZDA 71-78 includes RX4 & Cosmo models	\$10.95
9941	MAZDA 827 79-81 covers all models	\$12.95
8105	MAZDA 626 79-81 covers all models	\$12.95
0593	MAZDA 808, 818 72-78 covers all models	\$12.95
1746	MERCEDES-BENZ 220 59-65 covers all mtds	\$12.95
8197	MERCEDES-BENZ 250 65-68 plus 1900, 2000, 2200 models	\$10.95
9485	MERCEDES-BENZ 350, 280 68-72 all models plus 230	\$12.95
0416	MERCEDES-BENZ 68-73 mtds 220, 230, 300 & diesel mtds	\$12.95
8308	MERCEDES-BENZ 350, 450 71-80 for 350S, 450SE, SL, SLC	\$12.95
8439	MERCEDES-BENZ 74-79 mtds 230, 240, 280, 300 & diesel	\$12.95
9436	MERCURY MONARCH 75-80 covers all models	\$10.95
0592	MERCURY ZEPHYR 78-81 all models inc. turbocharged	\$12.95
1098	MG MIDGET 68-80 all models plus A-H Sprite 58-71	\$12.95
1720	MGB, MGBGT 69-81 for all roadster & coupe models	\$12.95
0884	MONZA, CHEVROLET 75-80 plus Astra Starline/Skyhawk	\$10.95
0479	MUSTANG 68-73 covers all models	\$12.95
8272	MUSTANG 74-78 covers all 4, V6 & V8 models	\$12.95
9386	MUSTANG 79-82 covers all engines and models	\$12.95
0951	NOVA, CHEVROLET 71-79 covers all models	\$12.95
7107	OLDS CUTLASS 70-83 for all rear-wheel drive models	\$12.95
8465	OLDS CUTLASS CIERRA 82-83 all mtds plus Pontiac 6000	\$10.95
9851	OLDS FIRENZA 82 for all models plus Pontiac GM-J cars	\$12.95
9148	OLDS OMEGA 80-83 covers all mtds plus Oldsmobile Phoenix	\$10.95
6308	OLDSMOBILE 68-76 covers all 88 and 98 models	\$12.95
8473	OLDSMOBILE 77-83 covers all 88 and 98 models	\$10.95
8273	OLDS 66-75 for all models inc. GT, Kadett, Manta & 1900	\$12.95
0711	PEUGEOT 504 DIESEL 74-80 covers all models	\$12.95
7134	PEUGEOT 504 68-79 for all gasoline engine models	\$12.95
0883	PINTO 70-80 covers all models inc. Mercury Bobcat	\$10.95
0874	PLYMOUTH 68-76 Fury, VIP, Gran, Suburban models	\$10.95
1259	PLYMOUTH HORIZON 78-82 covers all models inc. TC3	\$12.95
8065	PLYMOUTH RELIANT 81-82 covers all models	\$12.95
0851	PONTIAC 66-76 all full-size inc. Bonneville, Catalina, GP	\$12.95
8473	PONTIAC 77-83 all full-size inc. Bonneville, Catalina, GP	\$10.95
0489	PONTIAC TEMPEST 68-73 all models inc. GTO, Le Mans	\$10.95
9535	PORSCHE 911 65-82 covers 911, 911E, 911S, 911T & 911T	\$12.95
9834	PORSCHE 914 70-76 all models inc. 914 6	\$12.95
0993	PORSCHE 924 75-80 covers all models inc. Turbo	\$12.95
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0372	RENAULT LeCar 75-81 covers all models inc. RS	\$12.95
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8058	SUBARU 72-82 for all 1300-1800, BRAT and MPV models	\$12.95
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0829	TOYOTA CELICA 71-81 covers all models except Supra	\$12.95
9812	TOYOTA COROLLA 68-82 for all models inc. 5-speed trans	\$12.95
7132	TOYOTA CORONA 70-82 covers all 4-cyl models	\$12.95
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8192	VALIANT 68-76 all mtds inc. Scamp, Signette	\$10.95
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1227	VOLKSWAGEN BEETLE 54-67 all mtds inc. Karmann-Ghia	\$12.95
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8300	VOLKSWAGEN RABBIT 75-82 gas & diesel plus pick-up	\$12.95
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9409	CHEVY SMALL BLOCK, how to rebuild	\$7.95
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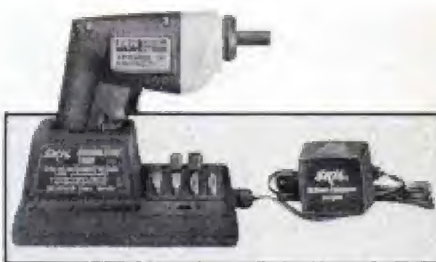
NEW —NOW

HOME & SHOP

Three-position locking hinge



This three-position hinge, called the Spring hinge, features a novel spring and lock action. It locks in 0°, 90° and 180° positions so doors won't close accidentally. The Spring hinge is available at hardware stores for \$1.15. Contact Paul D. Rand Co., Box 510, Hollywood, Calif. 90028 for more information.



Drill power pack

A convenient charging stand (\$9.95) is available for Skil Corp.'s Model 2000 and 2003 cordless screwdrivers. Two charging modes offer a three-hour total recharge or a standby charge. The stand can be wall- or bench-mounted. The charging stand is made by Skil Corp., 4801 West Peterson Ave., Chicago, Ill. 60646.

Portable sander/grinder



Black & Decker has introduced a two-speed, portable sander/grinder called the Powerfile (\$259). Its 3/4-hp motor drives an abrasive belt on the interchangeable, pivoting arm. For details, contact John Butler, Black & Decker, 626 Hanover Pike, Hampstead, Md. 21074.



Window slider



Here's a new wood slider window which competes in price with aluminum windows, but features an attractive wood interior. The window exterior is clad in durable aluminum for easy maintenance. Sizes range from 2×2 ft. (\$100) to 5×8 ft. (\$323). Contact Caradco Corp., Dept. Cs-12, Box 920, Rantoul, Ill. 61866.

Vinyl moldings



Gossen Victorian moldings, by United States Gypsum Co., Dept. 122-ZZ, 101 South Wacker Dr., Chicago, Ill. 60606, are made of flexible, durable, cellular vinyl in a choice of five colors and 10 designs. They are available in 7-, 8- and 10-ft. lengths. Prices range from 25 cents to \$2.50 per linear ft.

Two new tape measures to try

Stanley now offers a 30-ft. Powerlock tape and a 50-ft. Powerwinder tape. The Powerlock (\$16.95) features an exclusive blade-return control to prevent whiplash and prolong blade life. The 50-ft. Powerwinder (\$21.95) has replaced a hand-cranked blade return with a pushbutton, spring-powered mechanism. Send inquiries to William Shanahan, The Stanley Works, Box 1800, New Britain, Conn. 06050.

PM



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WOOD, PLASTIC, ALUMINUM CUTTING 1/2 H.P. - 14" BAND SAW

Here is a sturdy band saw that's ideal for your general purpose straight and intricate sawing. It easily cuts through material up to 2" high and 13" wide. Its powerful 1/2 H.P. motor will meet most cutting needs.

SPECIFICATIONS

Cutting Angle Range..... 45°L, 45°R
Table Size..... 14" x 14"
Table Tilting..... 10°L, 45°R
Blade Speed Range..... 3000FPM
Blade Size..... 3/4" x .026" x 92.5" 6-teeth per inch
Motor..... 1/2 H.P., 1750 RPM., 110/220V
Overall Height..... 65 1/2"
Height (floor to table)..... 43"
Height (table to guide)..... 6"
Blade to Frame..... 14"
Floor Space..... 19" x 20 1/4"
Weight..... 194 lbs.

Compare at
\$599.00

OUT THEY GO FOR ONLY

\$278.



1/2 H.P. METAL CUTTING BAND SAW

Ideal for the home craftsman or professional tradesman! Converts fast and easily to VERTICAL position.

SPECIFICATIONS

• 3 Blade speeds—65-120-220 FPM.
• Heavy-duty construction.
• Adjustable ball bearing blade guide.
• Table allows for contour cut, slitting & notching.
• O/R Height (horiz.) 38" • Vert. 54" • Ht. floor to table 54"
• Floor space 20"x42" • O/A Bed 26"x9 1/4"x3 1/4"
• Angular cuts 90° to 45° • Motor 110/220V, 60 Hz, 17.25 RPM • Capacity 4 1/2" round 4" x 6" rectangular.
• Blade size 1/2"x64 1/2"x.025" • WT. 153 lbs.

Compare at
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6" DELUXE JOINTER

Precision built for high speed, heavy duty, continuous production. Perfect for beveling, taper cuts, jointing an edge, jointing warped pieces and short or thin work.

SPECIFICATIONS

CUTTING CAPACITY: WIDTH 6" DEPTH 1/2".
SPEED 6000 RPM 18,000 CUTS/MINUTE.
3800 RPM 11,400 CUTS/MINUTE.
• Table surface: 38 1/2" x 7 1/4" W.
• Fence surface: 34 1/2" L x 3 1/4" H.
• Fence tilting: 0-45° (Left or right).
• Positive stops: at 45° & 90°.
• Measurements: 43"x13 1/2"x17 1/4".
• 3/4 H.P.- WT. 151 lbs.

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10" TABLE SAW

Made for professional use, this heavy duty contractors table saw is now liquidation priced within reach of everyone!

SPECIFICATIONS:

• Shipped unassembled • Capacitor-start 3450 RPM
1 H.P. motor 110V/12 amp AC 220V/6 amps AC
• Table measurements: 20 1/2" W x 27" D • Overall: 47" W x 38" D x 42" H. • Capacities: Depth of cut 3 1/2" and 2 1/4" at 45° • RIP 24" R/L of blade.
• Distance to front of blade 12 1/4" • Blade: up to 10" • 5/8" arbor • Speed 4500 RPM (60 Hz).
• 1 H.P. 2 POLES • WT. 220 lbs.

Compare at
\$695.00

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\$299.

16 SPEED DRILL PRESS

Perfect for home workshop or industrial use!

ENCLOSED BELT
GUARD CASE

3/4 H.P. MOTOR

These FLOOR or BENCH model drill presses are really HEAVY DUTY and built to withstand years of rugged use.

They drill fast into PLASTIC, WOOD, BRASS, ALUMINUM, CAST IRON and STEEL. The base and head are made of fine-grained cast iron and the column is extremely heavy for rigid and smooth drilling. The table swings 360° and tilts 0° to 45°. The powerful 3/4 H.P. motor and variable 16 speeds deliver maximum drilling efficiency.

Compare the features...compare the price...you'll quickly realize what a value these are! And (at a savings of up to \$500.00 over comparable drills) we know they'll sell out fast. Be sure and call or mail your order right away!

SPECIFICATIONS:

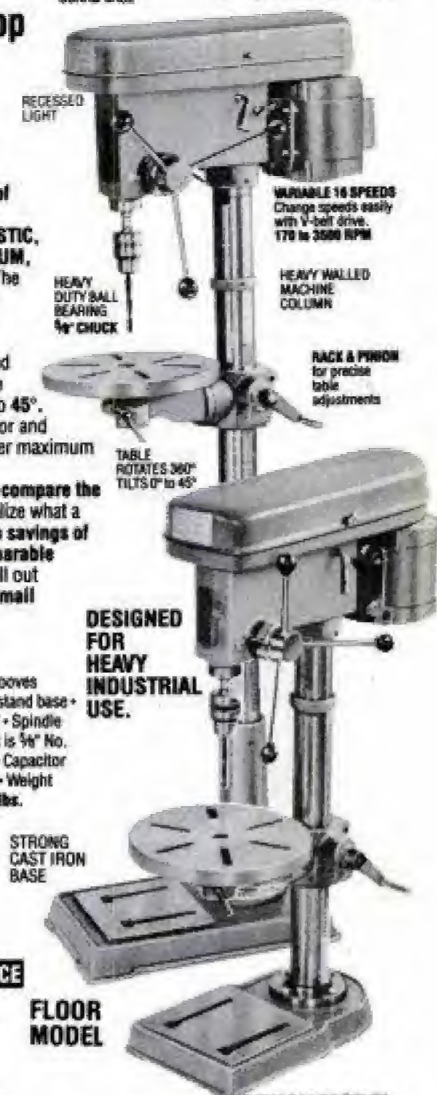
• 11 1/4" dia. table with "T" grooves
• 6 1/2" from spindle center to stand base
• Spindle to base (max.) 23 3/4" • Spindle to table (max.) 15 1/4" • Chuck is 3/4" No. 3 J.T. Arbor • Morse 2 taper • Capacitor start 110V motor; 10 Amps • Weight (bench) 160 lbs. (floor) 180 lbs.

Compare at up to
\$695.00

OUR LIQUIDATION PRICE

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ADD \$30.00 FOR
FLOOR MODEL



DESIGNED FOR
HEAVY INDUSTRIAL
USE.

STRONG CAST
IRON
BASE

FLOOR
MODEL

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4" jaw width.
Cold rolled
steel screw.
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_____ VICE ATTACHMENT @ \$15.00 ea. _____ 14" BAND SAW @ \$278.00 ea.
_____ Metal cutting BAND SAW @ \$188.00 ea. _____ 6" JOINTER @ \$278.00 ea.
_____ 10" TABLE SAW @ \$299.00 ea. I will pay Truck driver the freight charges upon delivery.

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Sun Rooms From Kits

From supersimple to spectacular, here's a sampling of what's available in sun room kits.



Two Everlite modules make a spa room addition to a master bedroom. The spa was added 20 years after the house was built. Handles at the ceiling open vents.

BY PENELOPE A. SPANGLER
Asst. Home And Shop Editor

Sun rooms are fast becoming the hot tubs of the '80s—the additions people want most for their homes. A sun room from a kit you assemble yourself—or have erected—not only provides additional living space, but can cost considerably less than a standard room addition. A sun room can also collect and store solar heat to warm itself and other rooms in the house.

In planning a sun room, you should determine where it will best receive solar gain. Weigh this against where it will look best on your home and where it will be most serviceable to your family. Then select the best kit to suit your needs and budget.

To accept the greatest amount of winter sunlight and solar heat, the widest expanse of sun room glass should face true south. However, a sun room can face up to 30° away from true south

toward the east or west and still be efficient.

Pick a location away from obstructions such as a garage and large coniferous trees. This is especially important in winter when the sun is at a lower angle, and more easily blocked.

Most sun room kits that are used as house additions are angled or curved lean-to types, with frame members of



This bay window from Brady & Sun extends 4 ft. from the house and is 8 ft. long. It's priced at \$1,995. Screens and kneewall awning windows are optional.

metal or wood and glazing of plastic or glass. These sun room kits often come in modules. You can purchase the number of modules that combine to form a room the entire length of your house wall, or any part of it. Some kits come in one- and two-story models.

To be a fully effective passive solar heat source, a sun room must have the following five elements: 1, a collector, such as a double layer of window glazing; 2, a tight thermal envelope composed of well-sealed glazing plus insulated walls, roof and floor; 3, storage mass such as a concrete slab floor to aid in storing heat and slowly releasing it; 4, a distribution system to get heat into the house; and 5, a control system for ventilating the heat outdoors.

If you select glass, which doesn't scratch, over plastic for the glazing, clear insulating glass is regarded as a good value for the money in cold climates or the Sunbelt. Clear triple-glazing is used in very cold climates.

To have a tight thermal envelope, the glazing must be sealed, and walls, roof and floor should be well insulated. The exact R-value of insulation recommended in the ceiling varies with the region and ceiling design. In northern climates, anything from R-39 to R-60 would save money. Recommended sidewall insulation levels vary according to region from R-19 to R-30 and more. Often, it's up to the homeowner to provide insulation, following the kit maker's recommendations.

Thermal mass in the floor and walls will store the heat absorbed from the sun and release it during the evening hours to keep the space comfortable at night and on cloudy days. In summer, a thermal storage system helps moderate sun room temperature by absorbing excess heat. Storage can be in several forms: concrete or brick floor, and/or water in tubes or other containers.

Sun room kits don't include the structure upon which the room rests. It is the homeowner's responsibility to pour footings, or erect a base structure. You should provide adequate perimeter in-

(Please turn to page 56)



Florex II from English Greenhouse has a bronze-finish aluminum frame and double glazing, with acrylic glazing on curved parts. The 10-ft.-wide unit comes with sliding doors and operable windows.

#1 TOUGH TRUCK

'84 FORD PICKUPS



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**#1 SELLING PICKUP
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The best-selling Ford offers a powerful advantage for '84—the husky 4.9L I-6, most torque in any pickup. Plus the 7.5L, biggest V-8. And 6.9L diesel with 26 more horsepower than Chevy. Choice of roomy

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Regular Cab, Crew Cab or big exclusive

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Quality is Job 1.

Ford's commitment to quality results in the best-built American trucks, based on a survey of owner reported problems during the first three months of ownership of 1983 trucks. And the commitment continues in 1984.

BUILT FORD TOUGH



SUN ROOMS

(Continued from page 54)

sulation for this part of the sun room. You can do it by installing 2 x 24-in. polystyrene (rigid insulation) such as Foamular along all outside walls. The insulation can be placed horizontally inward from the footing, or it can be placed vertically against the footing inside wall. Either way, be sure the insulation provides a thermal break between the poured slab and footings.

You can also insulate by installing polystyrene vertically along the exterior of the wall. However, in such installations the material must be covered with a coating to protect it from sun and damage.

To get heat from the sun room into the house, you can use a small circulating fan. Most kit makers offer suitable fans as optional equipment. Place the fan close to the ceiling and locate a cold-air return vent near the floor.

A system for automatically ventilating excess heat to the outdoors on warm days can consist of a thermostatically-controlled exhaust fan. Other options you should consider for tempera-

ture control are insulating shutters to block cold air infiltration at night, and shades or blinds to block unwanted solar gain during hot, sunny days.

Before you begin building, check that there are no underground gas, electric, water or septic lines that may need routing under the sun room site. Also check with your local building department. **PM**

MANUFACTURERS—SUN ROOM KITS

Aluminum Greenhouses Inc., Box 11087, Cleveland, Ohio 44111; catalog, \$2.

The Everlite prefabricated units have an aluminum frame (natural, or for an additional cost, baked-on enamel or anodized paint in a variety of colors) and double-strength glass glazing. Sealed insulated glass is offered as an option on most models. Lean-to models used as room additions include a special design for around the corner installation. Heating, venting, shading and cooling equipment is optional.

Brady & Sun, 97 Webster St., Worcester, Mass. 01603; information kit, \$1.

The LivingRoom uses laminated, arched yellow pine beams and insulated and double-pane tempered glass. Roof, endwall and kneewall sections have insulation bonded between plasterboard and exterior aspenite sheathing. You provide the foundation and exterior sheathing. Options include kneewall awning windows, solar screens, curved windows, insulated shutters and circulating fans.

English Greenhouse Products Corp., 11th & Linden (Please turn to page 59)



The Garden Way sun room is 10 ft. deep and 12 ft. long (\$6,200 for the basic kit). You have an option of adding 4-ft. sections to the overall length of the sun room.



This 16 x 24-ft. cedar room kit by Habitat, priced at \$10,630, is the largest model the company offers. The Caldera spa can also be ordered from Habitat.



Sun System's seven-bay model (\$5,832) from its B100 series features tempered glass, awning windows and a sliding glass door. The popular four-bay model costs \$4,285.



The Perfect Gift

Unmatched in Performance

Highly Desirable

Experts Choice

Exclusive Source

Convenient Shopping

No-Risk 30 Day Trial



THE RADAR DEFENSE KIT

ESCORT comes complete with a molded carrying case, detachable power cord, visor clip and hook and loop mounting, spare fuse and alert bulb, and a comprehensive owner's handbook.



Overwhelm Your Favorite Driver

A good gift is more than a surprise; the perfect gift hits the mark. If there's a driver on your list, you can give ESCORT with absolute confidence. Here's why.

First Class Performance

When radar is out there, ESCORT's superheterodyne circuitry will find it. Over hills, around curves, hidden in the bushes, anywhere. But don't take our word for it. In its most recent comparison test, *Car and Driver* rated ESCORT number one, calling it "...clearly the leader in value, customer service and performance..."

Coveted Equipment

For several years after its introduction, demand was so great that customers waited up to six months for delivery. We finally had to build a new factory to keep ahead of the demand.

Users quickly came to depend on ESCORT's unique radar report—the way its variable-pulse audio warning, analog meter and amber alert lamp work together to give a precise indication of radar type and range.



And last spring we added our STatistical Operations Processor (ST/O/P™), a new electronic circuit—the first in the industry—which rejects false alarms caused by less elegantly designed detectors. With ST/O/P, ESCORT is more desirable than ever.

Attention To Detail

Owners also take great pleasure in ESCORT's look and feel. Its extruded aluminum housing has the right heft. The visor clip is a rugged combination of Lexan and spring steel. The volume control is as silky as that of an exotic stereo. We even add a small photoelectric sensor (you can see it next to the red power-on indicator). It senses the ambient lighting in the car and adjusts

the brightness of the alert light to suit. These are just a few of the many details that make ESCORT unique.

But all this sophistication doesn't mean that ESCORT is hard to use. Just install ESCORT on dash or visor, and plug it into the lighter. We even include an adapter for European lighter sockets. And ESCORT's low-profile shape, finished in non-glare black, looks right at home in any car.



Apart From The Crowd

We've always felt that users of precision electronics are entitled to deal with experts. That's why we only sell ESCORT direct from our factory. There are no middlemen. When it comes to customer satisfaction, we take full responsibility.

Our system of direct sales offers special benefits to the gift giver. You needn't worry about inadvertently buying a discontinued model still in a store's stock. Your gift will never be seen marked down in the discount chains. Moreover, giving an ESCORT shows you were concerned enough about quality to track down the only source. And there's another advantage.

Easy Access

ESCORT lets you do your Christmas shopping by phone and avoid the retail hassle. We're only a toll-free call and a parcel delivery away. And ESCORT is guaranteed to please. Holidays or any time, take the first thirty days as a trial. If you're not absolutely satisfied, return it and we'll promptly refund your purchase and mailing costs. We also back ESCORT with a full one year

limited warranty. *Car and Driver* called us the "class act" in radar detection. So order now, ESCORT is the perfect driver's gift.

Do It Today

It's easy to order an ESCORT, by mail or by phone.

By Phone: Call us toll free. A member of our sales staff will be glad to answer any questions and take your order. (Please have your Visa or MasterCard at hand when you call).

CALL TOLL FREE . . . 800-543-1608
IN OHIO CALL . . . 800-582-2696

By Mail: We'll need to know your name and street address, daytime phone number, and how many ESCORTs you want. Please enclose a check, money order, or the card number and expiration date from your Visa or MasterCard.



ESCORT (Includes Everything) . . . \$245.00
Ohio residents add \$13.48 sales tax.

Speedy Delivery

If you order with a bank check, money order, credit card, or wire transfer, your order is processed for shipment immediately. Personal or company checks require an additional 18 days.

ESCORT
RADAR WARNING RECEIVER

Cincinnati Microwave
Department 1268
One Microwave Plaza
Cincinnati, Ohio 45242-9502

Today, you're doing more than ever. So should your phone.

AT&T introduces GENESIS™ Telesystem.



Genesis telesystem is designed to help organize and streamline your life in so many ways.

The Genesis telesystem remembers all your important numbers, including emergency numbers. And it dials with just a touch. It times your calls and even has a built-in speaker.

But the really terrific thing about the Genesis telesystem is that you can customize it to fit your own

needs. Add an optional cartridge, and you've got one-touch access to call forwarding, call waiting, and three-way calling. Or add another cartridge, and you have the convenience of automatic re-dial of busy or unanswered numbers. And that's only half of it.

Soon, you'll be able to add a module with an electronic directory that memorizes names and numbers in alphabetical order.

Or the reminder cartridge, to remind you of special occasions and appointments.

Genesis telesystem. The more you do, the more it will help you do it.

We set the standards.



BREAKING MENTAL BARRIERS

They affect performance at work, in recreation, in relationships. They can be merely annoying or downright devastating. By their very nature, they seem insurmountable. The good news: They can often be overcome. A leading counselor discusses the problem and some solutions.

A young pole-vaulter had a problem. Time after time he would sprint down the track, place his pole and leap for the crossbar. Time after time, he sailed into the bar, not over it. The harder he tried, the more his body seemed drawn into the bar, like a nail to a magnet. He *knew* how to vault; he just had a mental block that kept him from doing it.

Now he's competing successfully again, thanks to Marlin Mackenzie, head of the sports-counselor training program at Columbia University Teachers College. Mackenzie is one of a growing number of professionals being consulted by athletes whose performance problems have a psychological basis. And there is a growing realization that crippling mental barriers of all sorts can be overcome, whether they involve hitting a golf ball or giving a speech, taking a test or talking to the boss.

"Any given goal has a strategy," says Mackenzie, "a mental 'map' of the best way to reach that goal. The map will often be largely subconscious, and it is usually a complicated set of concrete sensory images—pictures, sounds, physical sensations—mixed with emotional images." In the case of the pole-vaulter, Mackenzie elicited the images that raced through the young man's mind in the split second it took to spring from ground to crossbar. "He was talking to himself, trying to get himself through the jump by 'hearing' words of encouragement. But words are too slow. He needed an image that would distract his mind from the task. His body knew how to jump—his brain had just forgotten that he knew."

Mackenzie told the vaulter not to think about jumping, but to think of the sound of his pole hitting the ground as the first note of a love song. The strategy worked almost

the first time he had a chance to use it.

Is there anything the average person can do to break through a mental barrier? According to Mackenzie, a positive mental image of the goal successfully attained is crucial. "If I say, 'don't think about pink elephants,' what's the first thing you think of?" he asks. "If you go into a job interview telling yourself not to stumble over your words, you picture the mistake—and often commit it. But if you picture yourself speaking clearly and well, your subconscious is channeled into the right groove and you're likely to live up to that picture."

It's hard to be your own therapist, Mackenzie says; some help is usually needed in identifying your mental map. But simply being aware that the strategy exists is a good first step. His recommendations: Focus on the outcome you want to attain. Deal with only one problem at a time; any goal can be broken down into a number of smaller subgoals that will almost certainly be less overwhelming. And realize that you are imperfect. There will always be setbacks; learn to accept them and move on to the next challenge.

"Most important is to be self-aware," says Mackenzie. He describes a potential Olympic athlete who had emotion-induced allergy attacks at nearly every practice session. Repeated counseling sessions couldn't uncover the root of the block. Finally, Mackenzie realized that the block itself was a subconscious strategy that produced the most desirable outcome for the athlete. "The answer was, he just didn't like competing in athletics," he says, "and found an effective way of saying so."



SPORTS LABS HONE ATHLETES' SKILLS

Over the years, American athletes have won few Winter Olympics events. Our last gold medal in bobsledding, for example, was in 1948; in Nordic skiing (cross-country skiing and ski jumping) and luge, we've never won.

Now, biomechanists affiliated with the Olympic Training Center, in Colorado Springs, are conducting sophisticated engineering studies that should not only help world-class athletes win championships but eventually benefit recreational athletes and the handicapped as well.

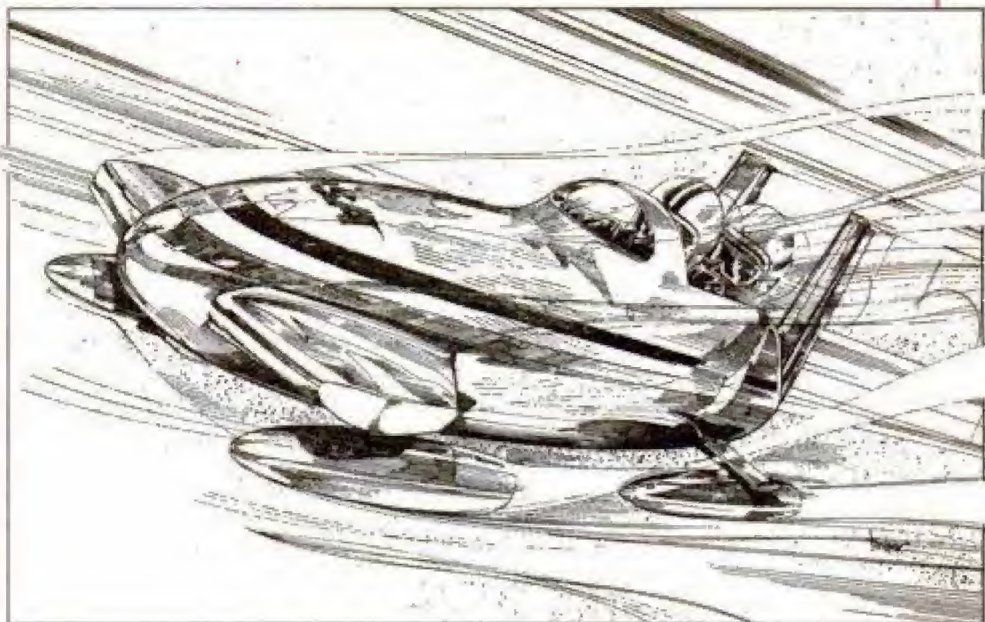
Studies of Nordic skiing have shown that summer training methods can sometimes be counterproductive. Ski jumpers practice on plastic-bristle mats that have greater friction than snow does, slowing them down even more on takeoff. Says Charles Dillman, head of the biomechanics lab, "Deceleration has a significant effect on technique. It could hurt performance on ice and snow." Similarly, cross-country skiers who use wheeled skis may also be developing bad habits.

How does skating technique affect speed in ice hockey? Acceleration occurs in the first 1.5 seconds—three steps—after pushing off. To go faster, players should bend their legs. "In just two seconds, a skater with flexed legs moves three feet farther than an upright one," Dillman says.

The first few steps are also crucial for bobsledders. They begin from a standstill and push their craft to the fastest possible speed before the start. By analyzing high-speed films of American and foreign squads, biomechanist David Barlow, of the University of Delaware, discovered why the foreign teams have more "push": "They take longer strides and are always in contact with the ground." Since his findings, 22 U.S. team and course records have been set.

Barlow is now working with luge racers, who ride on their back, feet-first, down a chute on a small sled. Some boost their momentum by "paddling" on the ice with their hands; others let gravity take over. Which technique wins gold medals? The study is not yet completed, but in Barlow's opinion, "Paddling appears to be highly effective for people with a certain build."

THE RUBBER TREE is an excellent shot-putter. It can burst its fruits, then hurl its seeds 30 feet or more.



HIGH-TECH SLED VIES FOR GOLD

The American bobsled team should have a good chance for victory at the Olympic Games this winter. Two futuristic-looking two-man sleds have been carefully crafted to break the Europeans' half-century hold on the gold medal.

Bobsledding is a speed sport that requires the driver to negotiate a mile-long, twisting run at velocities up to 90 miles per hour. It is so fast-moving that races are won by only hundredths of a second. The sleds have four runners and ride several inches above the ice. The driver steers with ropes attached to the two runners in front. A good sled is safe yet fast, light yet strong.

With the help of a computer and extensive wind-tunnel tests, the new sleds have been designed to cut down air turbulence. They were built by Chelsea Design Associates, Inc., in Douglaston, New York,

A winning bobsled calls for durability, lightness and unparalleled speed. If new sleds can meet these design requirements, they will go on to the Winter Olympics.

and are equipped with specially fabricated runners that should help keep friction to a minimum. Also, they were constructed with light, composite materials that actually become stronger at colder temperatures. Depending on how the sleds fare in test runs, some modifications, such as suspension changes, may still have to be made.

Allan Hachigian, president of the U.S. Bobsled Federation, says that the sleds, which have already been run at Lake Placid, "are potentially world class." They are being taken to Europe to compete against other sleds, including one designed by the Navy in conjunction with NASA. The sled that turns out to be the best will head for the Olympic Games in Sarajevo, Yugoslavia, in February. Ultimately, the choice of the competing sled is left up to the federation.

COMPUTERIZED SKI BINDING

About 90 percent of skiing-related leg injuries occur when the mechanical binding holding a skier's boot to the ski doesn't release properly. A computerized binding now being developed may change that statistic.

The new binding contains a device that converts pressure between boot and ski into electrical signals. These are sent to a computer, mounted on the ski, which monitors the twisting of the leg. When the stress becomes too great, the binding releases. "The program tries to protect the skier against knee injury," notes mechanical engineer Maury Hull, of the Universi-

ty of California, Davis.

Powered by both battery and the sun, the device must be recharged periodically. "If there's no sun, the battery lasts ten to twelve hours," Hull says. "With sun, it will last up to a week." The binding is activated automatically when the skier steps into it.

An early prototype was connected to a lunch-box-size computer and strapped to a skier's back. A smaller, ski-mounted version the size of a cigarette pack will be tested this winter. "Ultimately," says Hull, "the computer will fit within the binding itself."

LIZARD TAIL AIDS RUNNING RESEARCH

Marathon runners and lizards apparently depend on the same mechanism, called anaerobic metabolism, to achieve their goals. Runners need it to finish a race; lizards, to escape predators.

The link was discovered by Benjamin Dial, an evolutionary ecologist at Texas A & M, during a study of lizard defense strategies. Some species drop the last few inches of tail when pursued. The fragment, which twitches as long as five minutes at rates approaching 300 times a minute, draws predators' attention while the now-tailless lizard escapes.

The value of such a decoy is obvious. Less obvious is how it works. With no lungs, the tail cannot get the oxygen it needs for normal energy production.

Dial theorizes that the tail burns energy without oxygen, just as athletes must do who burn oxygen faster than they can take it in. They begin to burn glycogen, a complex form of sugar. This is an inefficient way to make energy, though, and it results in the production of a toxic substance called lactate. It is thought that lactate causes the "wall" of fatigue and nausea that hits runners about 20 miles into a marathon.

Sure enough, excess lactate was found in lizard tail fragments. Dial hopes this animal model of anaerobic metabolism will lead to a better understanding of muscle performance in humans. ■

TIMING WORKOUTS FOR WEIGHT LOSS

Exercise is good for weight reduction, and well-timed exercise is better yet. Research at Cornell University indicates that the body burns calories faster when exercise takes place within a few hours after a meal.

Nutritionists David Levitsky and Eva Obarzanek found that the rate of calorie burning, or thermogenesis, is even higher when the meal is a heavy one. The body seems to compensate for overeating.

To help it along, dieters are advised to eat their heaviest meals early in the day, when more active behavior is likely to take place; planned exercise should follow within three hours of mealtime. ■

MORE BLUE SPECIES of flowers and more blue examples of multicolored species are found at higher altitudes. No one is sure why.

WIND TUNNEL CUTS SKIERS' DRAG

The ski jumper feels the rush of wind roaring past as he floats suspended in midair, his slightest move monitored on a video screen and meters embedded in the floor below. He and the rest of the U.S. Olympic Ski Team are streamlining their style in preparation for the 1984 Games. And they're doing it with the help of a 120-foot-long wind tunnel at Calspan Advanced Technology Center in Buffalo, New York.

Michael Holden, principal aeronautical engineer at Calspan—and a skier himself—convinced the firm to let the team use one of their wind tunnels so they could pare crucial fractions of a second from their race times. "The tunnel simulates the conditions a skier faces," says Holden. "The most effective aerodynamic position is different in each situation."

For downhill racers, the goal is simple: Reduce drag. Each team member is placed in stances typical of certain sections of the course and then buffeted with winds of up to 60 miles per hour. A series of sensors detect the air deflected from his body, and a computer determines the amount of drag.

For ski jumpers, the goals—and the setup—are more complex. During an actual jump, the skier is free-falling through space. To re-create this effect, Holden devised a system of cables that suspend the skier from the ceiling of the tunnel. The skier can then try out various body positions and ski angles to reduce drag and increase lift—in effect making his body into a gliding wing.

Holden got the idea while attending the 1980 Winter Olympics in Lake Placid, New York. "Prior to this training method, a skier learned by watching others. Now he learns by the feel of the air against his body and can respond to similar conditions on the hill." ■



Suspended in a wind tunnel, a ski jumper can fine-tune his ski angle and stance, getting as much lift as physics allows.

THE UNITED STATES is the third most volcanically active country in the world, with 53 volcanoes having erupted in recorded history. Only Japan and Indonesia can boast (or lament) more.

PUMPING IRON ELECTRONICALLY

Imagine the scene in a weight-training gymnasium: bodies sweating, steel barbells clanging, grunts filling the air. It's a virtual throwback to Neanderthal times, right?

Guess again. The microchip has invaded the gym in the form of an exerciser called Ariel. Billed as "the first exercise system that thinks" and "a responsive partner," Ariel is a marriage between computer and weight-lifting machine.

The budding body builder installs himself or herself in the chair, grabs a bar and starts pumping, not iron, but a sophisticated substitute; Ariel creates the experi-

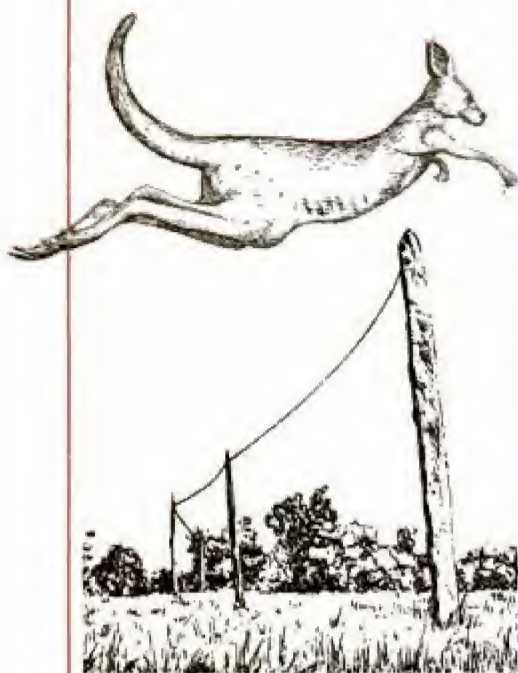
ence of weight lifting with hydraulic and pneumatic pumps. The advantage is that when an exerciser collapses while clean-and-jerking 400 pounds, there is no danger of broken bones.

Meanwhile, as muscles are straining, a video screen displays graphs and charts on amount of weight lifted, force exerted in a given time, speed, range of motion, and so on. Ariel even reduces "weight" as the muscles fatigue. At nearly \$20,000, it costs too much for most of us. When it arrives at health clubs, though, the lines may resemble those seen when Pac-Man hit the video arcades. ■

UPDATE

ANIMAL ATHLETES

The camel is a slow-moving creature. But what it lacks in speed it gains in stamina. This veritable beast of burden can walk 30 miles a day carrying a load that weighs half a ton.



The kangaroo, with its long, muscular hind legs, is a marvel of fitness. Weighing about 200 pounds, it can thrust its heavy body into the air and clear a fence nine feet high. While airborne, this leaping marsupial uses its thick tail as both a counterbalance and a rudder.



Never underestimate the strength of an insect. The tiny ant can boost a burden 50 times its weight. And the brawny bee, when tethered to a small load on wheels, is able to haul up to 300 times its own weight.

The elephant is a monument to muscles. Its trunk alone, which can do everything from bulldozing a tree to delicately picking up a pin, contains an amazing 40,000—about 70 times the number of muscles in your body.

One of the world's longest leapers is the flea: It can jump 13 inches—about 350 times its own length. For a person six feet tall, this would be like jumping approximately 2,000 feet, or almost seven football fields. No one yet has leaped even as much as 30 feet.

A seemingly inexhaustible jumper is the Oriental rat flea: It can jump 600 times an hour for three whole days without stopping.

The fastest muscle movement ever recorded belongs to the mighty midge. This tiny, agile insect can beat its wings 133,000 times a minute, about 100 times faster than a human can blink an eye—which takes all of one twenty-fifth of a second.



By land, air or sea, birds are masters of locomotion. The ostrich outruns any animal on two legs, carrying its 300-pound body at 30 miles an hour. The flight of the Indian swift sometimes exceeds 100 mph. And the gentoo penguin, by at least one account, can swim 22 mph. At this speed, the penguin keeps pace with one of the fastest-swimming marine mammals, the dolphin.

THE SOURCES OF STRENGTH

A world-champion body builder has no more muscles than does a 90-pound weakling. So what makes him so strong? What other qualities does he need?

Muscles are made of thousands of stringy fibers—a number that is fixed during childhood—which contract when doing work. Strength doesn't depend on the number of fibers but is a function of their thickness and how many of them contract simultaneously.

Exercise actually damages the muscles. During the recuperative stage, the muscle fibers increase in size. Exercise also trains more muscle fibers to work at one time. If a muscle is flabby or untrained, for example, only about 10 percent of its fibers will contract, whereas up to 90 percent of the fibers in a weight lifter's bulky biceps will contract.

Aside from strength, two other ingredients go into making an athlete: fitness and

endurance. Fitness is related to the condition of the heart. During exercise, there is an increase in the amount of blood returning to the heart from the muscles. A typical volume for a runner at rest is about 5 quarts a minute, compared with 30 quarts during a vigorous workout. This greater volume means more work for the heart—a muscular balloon that expands and contracts to take in blood and squeeze it out. Like any other muscle, the heart enlarges and gets stronger with routine exercise.

Endurance, or the length of time muscles can work, depends in part on how much fuel—in this case sugar—the muscles can store. A muscle that is continually exercised until it is depleted of sugar tends to store more when it refuels at the next meal. And more sugar can translate into greater endurance the next time the muscle is put to the test.

TENNIS KEEPS OLD SKELETONS STRONG

It has long been known that women's bones degenerate after menopause, increasing the risk of fractures. Now, a study at the University of North Carolina, Chapel Hill, suggests that tennis, jogging and other "weight bearing" exercises may keep their bones strong into old age.

According to Peter Jacobson, the orthopedist who directed the research, 400 sedentary women between 35 and 65 years old were compared with 80 women in the same age range who played tennis three times a week. In those under 55, there were no marked differences in bone structure. But in subjects 55 and over, the tennis buffs' bones were much stronger.

Not every sport maintains your bones, Jacobson cautions. Swimming, for example, doesn't put any stress on the skeleton. "You need the pain of gravity for it to work," he concludes.

TECHNOLOGY

LIQUID SCOPE WILL OUTSEE ALL

A giant telescope with a mirror of spinning mercury would reveal the structure of faraway galaxies. Relatively inexpensive to construct, it could be built with existing technology.

Ermano Borra wants to build a reflecting telescope with a mirror 100 feet across, more than five times the size of the largest one that exists. If it accidentally drops, though, it won't shatter. It will spill.

Borra, an astrophysicist at Quebec's Laval University, plans to make his mirror out of liquid mercury. The mirror is the heart, the magnifying core, of the most powerful telescopes, from Mount Palomar's to the Space Telescope now under construction. With his fluid version, Borra expects to gather previously unobtainable knowledge about the birth and structure of the universe.

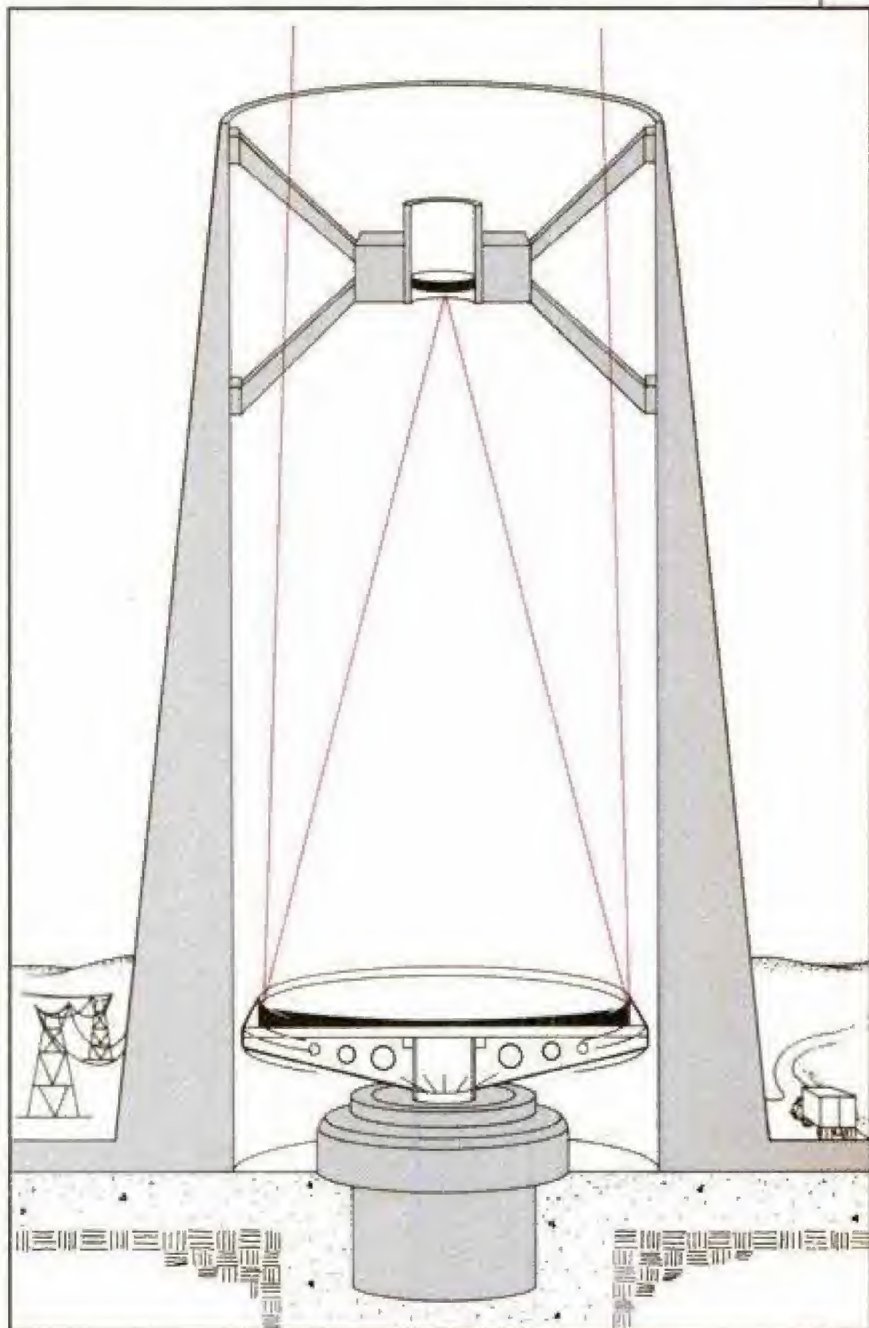
The plan is to put tons of mercury onto a giant, disk-shaped turntable with slightly raised sides, like beaten eggs poured into an omelet pan. As the disk slowly rotates, the mercury will surge gently toward the sides and dip in the middle—a phenomenon familiar to anyone who has stirred a pot of soup. The resulting curve in the mercury's surface will just match the curve of heavier, more fragile and more expensive traditional mirrors. A thin layer of clear glycerin on top will prevent evaporation of the toxic metal. So far, the biggest model Borra has made is three feet across. "We've tested it," he says. "It works."

His idea isn't a new one. In 1909 an American astronomer, R. W. Wood, built just such a mirror, a half-yard in diameter. It worked, despite minor problems with vibrations in the environment. The real difficulty was that it had to point straight up; otherwise it would spill out. But the Earth's rotation continuously redefines which part of the sky is straight overhead. The telescope would be aimed at a given star for too short a time to allow a proper photographic exposure.

Borra has the use of modern technology to deal with the situation: Each night's brief glimpse of a star or galaxy will be stored in a computer memory. Added together, the exposures will result in a usable image. And instead of photographic plates, he will use more sensitive, charge-coupled devices to record faint starlight.

"The big advantage over conventional mirrors is cost," says Borra. He estimates that a liquid-mirror device as big as today's largest telescope would cost only a thousandth as much—a few tens of thousands of dollars. "You could mount them on trucks," he says, "drive them all over the world and survey the entire sky."

There are other ways to build large mirrors. One method actively being explored involves connecting many



The liquid-mirror telescope would record light coming from faint objects passing directly overhead. Coupled to a computer, it could be one of the world's most powerful tools for analysis of the beginning of the universe.

small mirrors to motors that can shift their angle; the mirrors' movements would be coordinated by computer so that they reflect starlight onto a single point, simulating a single reflector. But Borra believes the simplicity and low cost of his telescope make it a viable competitor. His 100-foot idea is only the beginning, he says. "Much larger mirrors are theoretically possible."

POWDERED COAL TO REPLACE GAS?

"Fill 'er up" may have a different meaning before too long. Instead of pumping gasoline into your car's tank, you may be filling it with powdered coal.

Using the vast reserves of American coal would reduce the nation's dependence on foreign oil. Coal can now be converted to liquid fuels, but their retained energy is only 55 to 70 percent, compared with 78 to 90 percent for pow-

dered coal. And, says Richard Stettler, of General Motors' advanced products engineering group, powdered coal would be about half the price of petroleum-based fuels.

GM's engineers have successfully tested their coal, which has the consistency of powdered sugar, in a modified Cadillac Eldorado. The coal is carried by a conveyor belt from the fuel tank into a stream of compressed air and blown into a combustion chamber, where it ignites. As the coal burns, the hot gases given off drive a turbine. Stettler predicts the sys-

tem will be used first in trucks, railway engines and gas turbines used to generate electricity.

Cleaner coal—with less ash and sulfur residues—is needed to extend engine life and meet federal emission standards. "A lot depends on whether we can get clean enough fuel," Stettler notes. "It's been done in the lab, but large quantities are a problem."

The researchers are also trying to perfect an internal pumping system that can meter and deliver powdered coal to an engine at variable rates.

VIRUSES KEEP CROPS FROST-FREE

By the end of the decade, farmers may be dusting citrus and other valuable crops with viruses to keep them free of frost, which causes a billion-dollar loss in this country every year.

Surprisingly, many plants could tolerate temperatures as low as 21 degrees Fahrenheit—far below freezing—were it not for two strains of bacteria that thrive on their leaves. *Pseudomonas syringae* and *Erwinia herbicola*, so-called ice-nucleating bacteria, act as "seeds" for the growth of destructive ice crystals. Killing the microbes can protect the plants, but this is costly and a potential threat to the environment.

Now, atmospheric scientist Russell Schnell, of the University of Colorado, and Lloyd Kozloff, a virologist at the University of California, San Francisco, have isolated about nine viruses, called bacteriophages, that selectively kill *P. syringae* or *E. herbicola*.

A bacteriophage—resembling a micro-miniature mosquito—attaches itself to a bacterium and injects its genetic material into the cell. There the material replicates to form some 190 new viruses in just 90 minutes. The bacterium then bursts, releasing the viruses, which quickly spread. "They cause an epidemic among the ice-nucleating bacteria," Schnell says. Farmers would apply the viruses with hand sprayers or irrigation sprinklers, rotating the strains to keep the bacteria from building resistance. The viruses multiply rapidly, so only a few would be needed.

Frost Technology Corp., a Connecticut firm that plans to mass-produce the viruses, will study their performance in various weather conditions as well as their impact on the environment. The two bacteria have no known beneficial effects, and the viruses, which are deactivated by sunlight, should not spread beyond the field on which they're sprayed.

CARBON FIBER MAY REPLACE COPPER

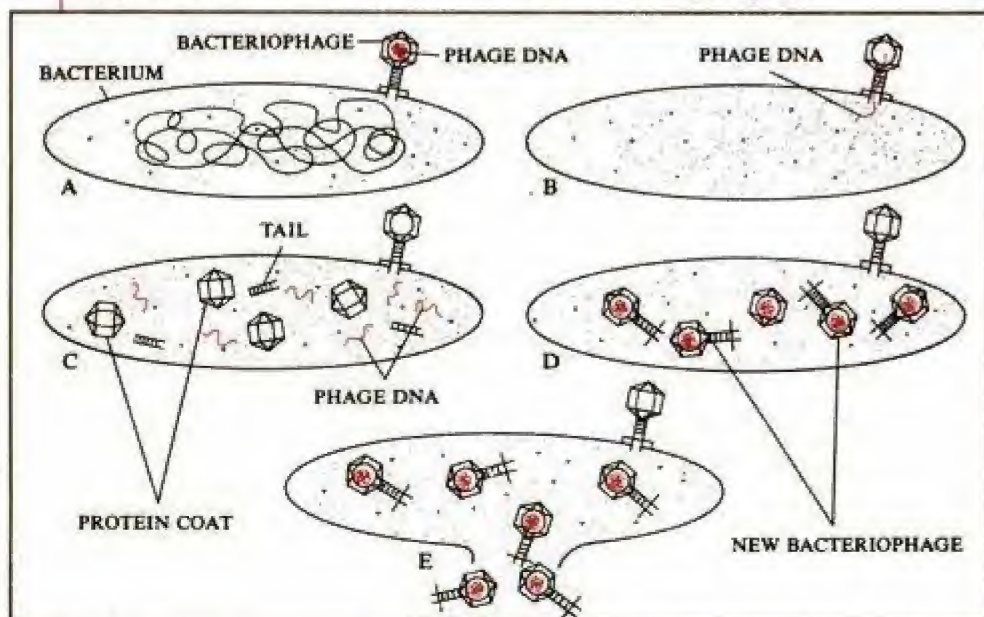
Graphite fibers are an engineer's dream: They are superlight and super-strong and have found their way into dozens of products, from golf clubs to fishing rods to airplanes.

A good thing has now been made even better. Physicists Peter Eklund and Azar Hazrati, of the University of Kentucky, have produced hybrid graphite that conducts electricity as well as some metals do. The payoff: It may eventually replace copper in power cables and could make lightweight aircraft lightning-proof.

Graphite is simply sheets of interconnected carbon atoms. To form the hybrid, the researchers alternate layers of graphite with layers of various metals or acids. Called "intercalated," the new material is seven times more conductive than the original. It's now as conductive as nickel and may one day equal copper, the best conductor widely available today.

Some aircraft skins are now made of graphite fibers mixed with epoxy, but if intercalated fibers were used instead, planes would be less susceptible to damage from direct lightning hits and to interference from nearby electrical storms. The greater the skin's conductivity, the larger the area over which the conductive energy of a lightning strike can be dissipated, Eklund explains.

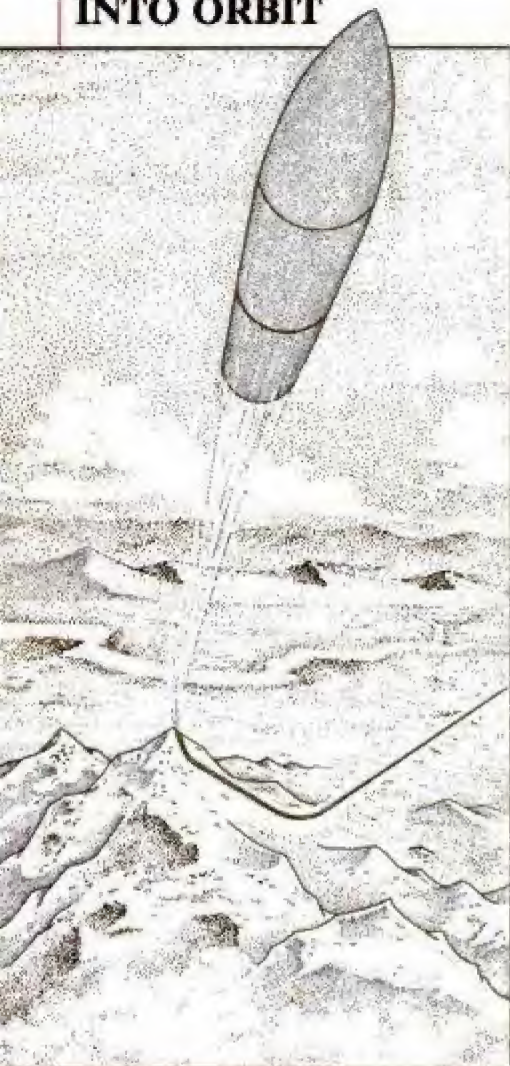
Graphite is cheaper and lighter than copper and has far greater tensile strength. Other uses for intercalated fibers might be to replace the copper windings in electrical motors; as a coating on computer cases to block the emission of electromagnetic waves; or, possibly, to provide more durable high-voltage transmission lines.



A bacteriophage pierces a bacterium (a) and injects DNA (b), which replicates and triggers the formation of protein coats and tails (c). These components assemble into new phages (d) that are released and spread when the bacterium bursts (e).

INSTRUMENTS aboard the IRAS satellite could spot a light bulb at the rim of the solar system.

TECHNOLOGY

RIDING A RAIL
INTO ORBIT

By means of special rails up the side of a mountain, a ton-size payload could be shot into space using electromagnetic energy.

Payloads may someday be launched into space not with rockets but with a gigantic electromagnetic catapult called a rail accelerator.

The device might be used to transport building materials to space colonies or to hurl nuclear waste out of the solar system. Because of the speed at which the projectiles would be launched—up to 47,700 miles an hour—the catapult couldn't be used to carry humans.

Project manager Bill Kerslake of NASA's Lewis Research Center, in Cleveland, explains that the accelerator would consist of two parallel conducting rails between which sits the object to be launched. Electromagnetic energy would create a force large enough to accelerate the payload along the rails and into space. The energy needed would be enormous—equivalent to what would be released if all the 1,000 or so power plants in the United States discharged their electricity simultaneously for one second.

NASA has studied the feasibility of using rail accelerators to launch ton-size payloads. For escaping the solar system the rails would have to plunge a mile into the Earth. For orbital missions, they might extend four miles up the side of a mountain. Because of the sonic boom occurring at takeoff, an accelerator would probably be placed in a remote area.

According to NASA, building such a system would take 20 to 30 years and cost as much as \$8 billion. While to many that figure might sound high, the rail accelerator could launch payloads 5 to 50 times cheaper than it would cost using the shuttle. Costs are kept down because heavy fuels wouldn't have to be carried into space. When the shuttle takes off, says Kerslake, nearly 80 percent of its weight (3.6 million pounds) is propellant. ■

SPACE SHUTTLE SHORT ON COMFORT

The space shuttle gets good grades for reliability and performance, but for comfort "it only rates a C or C+," says James Logan, chief of medicine at NASA's Johnson Space Center, in Houston.

The noise level aboard the spacecraft is somewhat lower than the legal limit for sound exposure in the workplace, set by the Occupational Safety and Health Administration (OSHA) at 90 decibels. But the 75-decibel drone of the shuttle's cabin fan goes on around the clock, while OSHA's standard applies to an eight-hour workday. Some astronauts report they find it hard to communicate if they're more than a few feet away from each other.

The spacecraft's thermal-control system is sluggish and manually operated;

temperatures have gone as high as 85 degrees Fahrenheit as a result.

Sanitation and the lack of storage space are also problems. Trash piles up, and the astronauts must spend valuable time tying down trash bags with elastic cords before reentry. Astronauts also complain that the lockers are so tightly jammed with gear that it's extremely hard to repack them once something has been removed. And the specially designed toilet has to have a seat belt to keep the occupants from floating away. There is no such restraint when it's being used from a standing position.

Even if the shuttle doesn't provide the best in accommodations, no one has any doubts about its providing the ride of one's life. ■

ASTRONAUTS AGE
LESS IN SPACE

It's been clear for some time that life in space can be hazardous to health. Now it appears there may be benefits too. On long voyages, astronauts may age less than people on Earth.

Under weightless conditions, space travelers have experienced everything from a reduction in bone and muscle mass to a decrease in cardiac output. Bone calcium is lost at the rate of about a half percent each month. This isn't bad on short missions, but it could lead to problems on a two-year journey to Mars. After about six months, an astronaut's bones would become so brittle that he might break his ankle simply stepping out of his spacecraft upon returning to Earth.

But to balance the negative aspects of zero gravity, neurobiologist Jaime Miguel, recently retired from NASA's Ames Research Center in California, predicts that living in space will slow human aging 10 to 15 percent. He bases his theory on experiments performed with fruit flies, rats and mice as well as on studies of astronauts themselves.

Miguel explains that on Earth, one third of all the calories we eat are burned in the fight to counteract gravity. Thus, in the gravity-free environment of space, we would not need as much food. Less food means a reduced metabolic rate, and there are some indications that the slower an organism's metabolism, the longer its life span.

To date, astronauts have not shown evidence of burning fewer calories in space. But NASA scientists think that during short missions (so far, American astronauts haven't remained in space longer than 84 days), the body may not have enough time to fully adapt to the new environment. With the advent of space stations, though, there may be some dramatic changes. ■

TO LIVE IN THE same fashion we do today without any help from machines, every person in the United States would require at least 80 servants.

THE TOTAL AMOUNT of energy detected so far by modern ground-based radio telescopes is less than that of a single snowflake hitting the Earth.

—Submitted by Jim Bowman

RESEARCH ROUNDUP

HEART DRUG STOPS STAGE FRIGHT

All of us have experienced stage fright sometime, whether giving a piano recital, acting in a school play or being put on the spot at a business meeting.

Researchers have now found that propranolol, a drug that is widely used to lower blood pressure, also dramatically reduces the symptoms of stage fright.

The sweaty palms, dry throat and pounding heart are all due to adrenaline—a chemical produced in nerve cells that triggers man's "flight or fight" reflex. Charles Brantigan, a cardiac surgeon (and avid musician) at the University of Colorado Health Sciences Center, in Denver, directed two studies in which either propranolol or a placebo was given to a total of 29 musicians just before they gave solo recitals.

The drug lowered heart rates and blood pressure, but for the musicians there was a more significant result: Critics rating recordings of the performances had an "overwhelming preference" for those of the medicated subjects. ■

HEADACHE HABITS

Most headaches are actually muscle aches, according to Samuel Razook, director of the Facial Pain Clinic at Emory University in Atlanta.

An analysis of headache sufferers has shown that 90 percent of all headaches are caused by muscle strain. And the muscles of the neck and head can be thrown out of whack by anything from chronic slouching to carrying a heavy briefcase or shoulder bag to cradling a telephone under the jaw.

Razook adds that even sitting in one position too long—especially if your head tilts forward, as when you're typing or reading—can produce a pounding pain in the head. ■

SHAKE THE HABIT

There may be a simple cure for people who consume too much salt: Put smaller holes in the top of the shaker. That is one conclusion of a report in the journal *Nature* by researchers at the University of New South Wales, in Australia.

They observed the behavior of hundreds of diners in restaurants and on an airliner. The results: Smaller shaker holes dramatically reduced salt intake. Placing the shaker at a distance cut back on salt use even more. ■



COLORED FRUIT LURES EARLY BIRDS

Plants that produce fruit seem to have evolved their edible extremities to tempt animals into eating—and dispersing—the seeds encased within. Now, a study shows that some plants advertise their wares better than others.

Mary Willson, an ecologist at the University of Illinois, Champaign, reports in the journal *Oikos* that red-and-black clusters, such as a branch of ripening blackberries, attract more birds than black, ripe fruit alone. The advantage? By attracting birds sooner, the brighter displays may give the plants' progeny a head start in the race for space. ■

WHY ARE HUMAN PALMS PALE?

Of all the primates, only one—man—lacks pigment in its palms and fingernails. Anthropologist Gordon Hewes, of the University of Colorado, Boulder, speculates that this unique feature evolved because of the importance of the human hand in communication and teaching.

Reporting in the *Journal of Human Evolution*, Hewes says the conspicuous lightness of the palms would have proved a distinct advantage to early man when signaling at a distance, teaching a manual task or interacting in the dim, flickering sphere of light around a fire. He estimates that man's productivity might have been extended by 10 percent with those extra few hours at dusk or dawn—all because of the paleness of his palms. ■

TOXIC BATTERIES

The same dangerous mercury compound that accumulates in some fish has been found in common dry-cell batteries.

Reporting in the journal *Science and the Human Environment*, researchers from the University of Tsukuba, in Japan, say that a careful analysis of the contents of store-bought batteries turned up methyl mercury. They warn that discarded batteries could pose a health hazard. ■

WHALE TALK ISN'T SMALL TALK

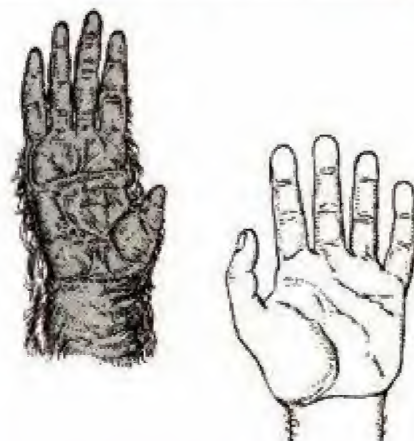
Peter Tyack has confirmed that the song of the humpback whale is a form of communication. He has also confirmed that research needn't be dull or dry.

Tyack, a biologist at Woods Hole Oceanographic Institution, reports in *Behavioral Ecology and Sociobiology* that recordings of humpback sounds, including those of battling males, got an unexpected response when played in Hawaiian waters: Time after time, whales up to 50 feet long charged his 15-foot boat, passing only a few feet beneath the keel. ■

EARTH'S BIRTH

It has been thought that Earth's iron core was formed when molten iron migrated down through its less dense surroundings under the pull of gravity.

Now, astronomer William McCrea, at the University of Sussex in England, says it is more likely that iron particles floating in space were magnetized by the sun's energy and came together in a clump that became the core. ■



Top illustration by Meryl Meisler; bottom illustration by Howard Friedman

POPULAR MECHANICS • DECEMBER 1983

SUN ROOMS

(Continued from page 56)

Sts., Camden, N.J. 08102; the catalog sells for \$1.

Three models are available with frames of bronzed aluminum and single-glazed (horticultural), double-glazed, or clear tempered insulating glass with acrylic in the curved portion. Awning-type windows and insect screens are included. Exhaust fan kit including external hood and interior sun shades are optional.

Four Seasons Solar Products Corp., 425 Smith St., Farmingdale, N.Y. 11735; free brochure; kit containing sample of System 4 framework, glazing and shade fabrics \$25, returnable and refundable.

Four seasons makes a variety of sun rooms with bronze or white finish aluminum; other colors are available. Glazing is insulated panels of double or triple glass. The new System 4 Sun Room has a built-in shading system of quilted fabric in 48 colors for insulation and sun control. Other features are an exhaust system and drain system around glazing to prevent water leaks.

Garden Way SunRoom/Solar Greenhouse, Ferry Rd.,



The polyethylene glazing of Solar Resources' Solar Room snaps out and the screen awning shown snaps in for summer comfort. The change takes two hours.

Charlotte, Vt. 05445; information portfolio, \$3.

These sun rooms have a structure of laminated wooden beams and glazing of double-glazed tempered glass. The side walls and roof sections are heavily insulated with interior surface of MDO plywood and exterior surface of aspenite; customer supplies his own exterior sheathing to match the house. Choice of awning window or lockable door for each end wall. Options include summer shades and night insulation shutters, heat transfer system, automatic vent system, water columns for thermal storage.

Habitat, 123 Elm St., South Deerfield, Mass. 01373; \$1 for information flyer.

The Habitat solar room has a cedar roof and laminated cedar rafters and window stops, as well as exterior cedar siding. Glazing is insulated glass. You provide the foundation, shingles and some insulation. The complete kit, including a two-way fan and controller unit, starts at \$4,463 for a 10 x 12 model. Spas for the sun rooms are also available.

Lord & Burnham, Dept. 1060-CSB 3181, Melville, N.Y. 11747; buyer's guide and planner, \$2.

Solarium series has aluminum frame of white or bronze finish and tinted bronze insulated safety glass. Accessories include vent fan and interior blinds. Insulated Imperial series has uncoated aluminum frame, or bronze or white finish for additional cost. Glazing is insulated glass; roof sections are clear tempered safety glass. Optional thermostatically controlled, screened vent available.

J. A. Nearing Co. Inc., 9390 Davis Ave., Laurel, Md. 20707; color brochure, \$2.

The Janco Solaroom comes as both a curved and straight eave lean-to. Frame is bronze or white-finished aluminum; other finishes available. Glazing is tinted bronze insulated glass or clear if requested. Features include tubular framing system with concealed connections for clean-line appearance, and integral gutter for condensation control. Approximate sizes are: widths from 3 to 11 ft.; lengths from 7 1/2 to 25 ft., heights from 4 to 12 ft. Optional vent fan.

Solar Resources Inc., South Santa Fe Highway, Box 1848, Taos, N.J. 87571; free brochure, or kit with aluminum samples, \$12.

The Solar Room has a frame of anodized aluminum. Glazing is two layers of 6-mil polyethylene separated

by an insulating airspace created by a 36-w. blower. Frame can be bolted to 4x6 pressure-treated wood. For ventilation in summer, a screen-shade assembly replaces the glazing. Other options are window fan and controller; customer buys doors separately. Sizes are 11 ft. wide by 8 ft. (\$990) to 40 ft. (\$2,400).

Sun System Prefabricated Solar Greenhouses Inc., 60 Vanderbilt Motor Parkway, Commack, N.Y. 11725; 24-page catalog, \$1.

Sun System sun rooms have a white or bronze-finish aluminum structure, or optional colors. Glazing on the front and sides is double-thick insulated tempered glass; overhead curved glass is double-insulated, tempered and laminated. Outside aluminum parts don't come in contact with inside aluminum parts, so that heat cannot be conducted inside in summer, nor cold in winter. Accessories include automatic vent system, gable end fans, shading systems.

Sunwrights Inc., c/o H & H Sales, RFD 4, Kendall Pond Rd., Derry, N.H. 03038; free brochure.

The Sun-Kit is a custom kit based on a specific location and computed by a Sunwright dealer. Kits include: wood framing for end walls and openings, preassembled roof-ceiling truss system, insulating glass panels and window ventilation system. Also provided is one man-day of labor from company-trained personnel. Homeowner provides foundation, sheathing, insulation, and interior and exterior finishes. Kits are available for vertical wall, angled wall and two-story sun rooms. Sizes range from 5 to 14 ft. in lengths of 36-in. increments. Accessories include sunscreen and redwood bifold shutters for nights.

Vegetable Factory Inc., 100 Court St., Copiague, N.Y. 11726; free brochure.

Bronze-finished aluminum frame; panels of clear acrylic fiberglass with 1/2-in. airspace bonded to aluminum grid. Stakes or anchor bolts used in place of a foundation. Thermal-break system to reduce heat loss and cold air infiltration. Approximate sizes of lean-to from 5 to 12 ft. deep with length from 8 ft. in 4-ft. increments. A 5 x 8-ft. unit costs \$1,875. Options include absorber and storage mass called solar pod that is designed to hang on the back wall; energy shades and curtains; active heat distribution fan system.

Weather Shield Mfg. Inc., Box 309, Medford, Wis. 54451; free brochure.

SolarGreen sun room is wood-frame construction with quadruple-glazed windows, two layers of glass and two layers of solar film. Kit includes foam core foundation for under wall; wood frame; wall and roof panels with polystyrene foam core; glazing panels;



Two-story SolarGreen room from Weather-Shield contains 16 glass panels. Homeowner supplies siding to match house.

3 1/2 in.-dia. x 72-in.-long Energy Rods containing phase change material to store heat; door; fan for heat distribution; fan for ventilation; digital monitor; sealants. You supply pea gravel, concrete slab, floor insulation, roof shingles, interior and exterior finish wiring.

Glazing Systems Offered

Pella Rolscreen Co., Pella, Iowa 50219; brochure free.

Company supplies windows, doors, sloped glazing and aluminum connections. You supply the wood framing, foundation and insulation.

Solar Components, Box 237, Manchester, N.J. 03105; catalog, \$3.

Glazing and glazing installation accessories offered. Builder-owner supplies the structure and foundation.

Literature

Designing With Windows For Energy Efficiency is a 128-page book prepared by Andersen Corp. showing you how to build energy efficiency as well as extra space into a home. It's \$6.95 postpaid from Andersen Corp., Bayport, Minn. 55003.

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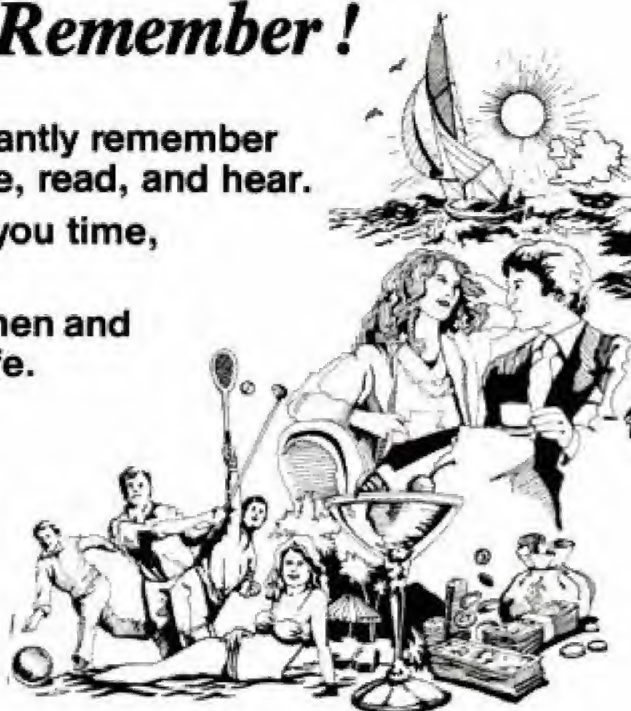
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10 Tips To Avoid Turntable Trouble

With a little effort, you can save money on turntable repairs. Here are solutions to 10 common problems.

BY HOMER DAVIDSON

You can make your turntable operate like new again with a few repairs and proper maintenance routines. Some of these adjustments may be all you'll need to prevent a costly, professional repair job. Here are 10 turntable maintenance problems you can solve.



1. Broken or shorted cables may be tested by interchanging the cables. Some of the changers may have the cable wires soldered directly into the circuit.

1. Broken or shorted cables

To determine if one channel is dead because of a broken cable, remove both phono plugs from the bottom of the changer. Some changers may have these cable wires soldered directly into the circuit. Remove the turntable platter and look for the wires or cables which go to the amplifier.

Grasp the small, metal plug ends of a cable. If you hear a loud hum from each cable, you may assume the amplifier is normal. Weak or no hum may indicate a defective audio channel. It may be necessary to remove the entire turntable



2. Platter dragging may be remedied by wiping off rim of turntable platter with alcohol and a lint-free cloth. You should also apply rosin or "slipping" compound.



4. A defective idler wheel can cause a bumping noise as well as a speed problem. Look for cracked areas on the rim. Wipe off any oil or grease on the wheel.

2. Platter drags

Sometimes, a turntable may begin to run slow (a turntable seldom runs fast, unless it has a variable-speed control). Slow speed may be caused by grease or oil on the turntable rim, idler wheel, motor belt or motor pulley. The photo shows how the rim of a turntable platter should be cleaned with alcohol on a lint-free cloth.

3. Belt replacement

If the turntable is running slow, you may notice signs of belt slippage on the platter's rim, such as shiny gray areas



3. Replace the belt with a new one that's about 1/8 inch shorter. To measure the old belt, lay it against a ruler. It may be necessary to piece the belt together.



5. Adjusting the idler wheel may solve some problems. Adjust the idler screw so the wheel is in the center of each speed area of the motor pulley.

inside the belt itself or dark, slick areas on the platter. You may also see small particles of rubber on the motor pulley, showing that the pulley is slipping inside the belt.

First, clean off the areas of the platter as detailed in the last problem. Then, if needed, replace the belt. Lay down the defective belt against the edge of a ruler. If the belt is in very bad condition, you may have to piece it together. Measure the length. Replace the belt with a new belt approximately 1/8 inch shorter than the original.

4. Defective idler wheel

With the platter off, the idler wheel, which controls speed, should be visible. Oil or grease on the idler wheel should

(Please turn to page 62)

TURNTABLE TROUBLE

(Continued from page 61)

be wiped off with alcohol and your cleaning cloth.

Check the idler wheel for rough or worn areas. Worn idler wheels often cause jerky or slow turntable rotation and must be replaced. Even if the

pulley. Then make your adjustments on the system.

6. No rotation

Lack of turntable rotation may be caused by a broken motor belt or a defective, frozen motor. You can often hear if a motor is working by placing your ear close to the turntable. If the

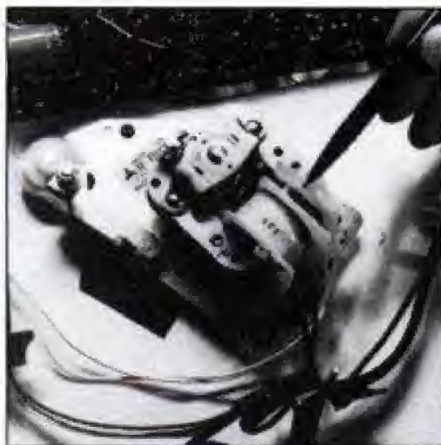
entire motor assembly back into the turntable.

7. Arm sticks in center

When the pickup arm will not trip in either manual or automatic mode, suspect a defective trip mechanism. The arm lever may not be properly engaging the trip pawl (lever).



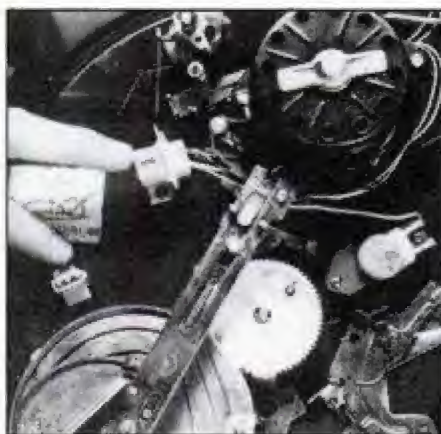
6. No rotation can be caused by a broken motor belt or defective motor. Try to rotate motor shaft manually (left). If it turns sluggishly, suspect frozen bearings. In this case, remove all the bolts holding the assembly together (right). Wash the motor bearing in cleaning fluid, then reassemble the motor and replace platter.



7. Arm sticking in the center of record may mean trip pawl is bent or misaligned. Usually, you can bend the trip lever to solve most arm rejection problems.



8. Adjusting arm height may be done with height adjustment screw located underneath arm pivot assembly. Adjust screw so pickup arm just clears arm post.



9. Intermittent operation can be caused by plugs that aren't seated properly in their sockets. Check all such connections. You should also check the cables.



10. Dead right or left channel may be from a defective cartridge. Lightly thumbing the stylus should produce a scratchy noise from both speakers.

idler wheel seems to be in pretty good condition, it may be improperly adjusted.

5. Adjusting the idler wheel

Once you've cleaned the idler wheel and made sure it's in good shape, make certain that it is adjusted properly when it's seated against the motor pulley. If the idler wheel runs high against the 45-rpm and part of the 33-rpm motor pulley, you may develop a jerky motion on the 33-rpm record.

Adjust the idler screw so that the idler wheel is in the center of each speed area of the motor pulley. Flip the speed selector switch of the turntable to each speed and check to see where the idler wheel rests against the motor

motor is the problem, you will have to examine it closer.

With platter removed, grasp the motor pulley with thumb and forefinger. Rotate the motor shaft. Sluggish motor bearings may hinder armature rotation. If the shaft will not rotate at all, the trouble is probably a frozen motor bearing. This is often caused by leaving the turntable on, accidentally, for a very long period.

In this case, remove the "C" washers that hold the motor in place and dismount the motor assembly. Remove the three or four bolts which hold the motor assembly together. Wash out the motor bearing with household cleaning fluid or TV tuner cleaner. Lubricate the motor shaft for easy rotation. Now, put

Pull the arm over and notice if the arm lever begins to strike the trip pawl. This trip pawl may be bent out of line so that it will not trip against the turntable's hub. Usually, you can bend and straighten the trip mechanism to solve most arm rejection problems.

8. Arm does not rise high enough

The pickup arm may appear weak and may not raise itself fully from the arm post. If it does not clear the arm post, it may fall off the rim of the record.

Look for a small adjustment screw underneath the arm pivot assembly. A small rod pin comes up and raises the

(Please turn to page 64)



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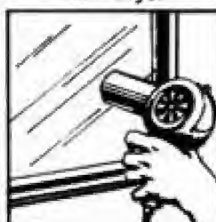
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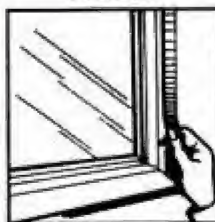
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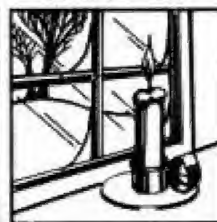
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10 TIPS TO AVOID TURNTABLE TROUBLE

(Continued from page 62)

arm assembly so that the arm will come over and set down at the start of the record.

The height adjustment screw may be connected right to the small rod pin assembly. Rotate the screw counterclockwise to raise the pickup arm. If the height adjustment screw is located on the pickup arm assembly, rotate the screw clockwise. Adjust the screw so the pickup arm will just clear the arm post.

Now, place a stack of records on the

changer. Notice if the pickup arm clears the arm post and sets down properly at the start of the record. Reject the record.

Readjust the height screw if the pickup arm touches the top record or does not clear the arm post.

9. Intermittent operation

Check the a.c. changer plug for intermittent turntable operation. Push the plastic plugs tightly together. If the motor begins to run when the plug is

pressed in, check for a bad or bent connection.

Solder a clip wire around the poor socket. Route connections around the socket when the socket terminals cannot be repaired.

Intermittent audio from the cartridge may be caused by a broken wire or cable. Flex the shielded cable with the turntable operating.

Inspect the small connecting wires at the rear of the cartridge plug. This is the place where they always seem to break off. A broken or loose outside shield connection may produce a low hum in the speaker.

10. Dead right or left channel

No sound, extreme distortion or even no right or left channel sound may be caused by a defective cartridge. And, low or intermittent audio may occur in either channel from the same source. Take a small brush and remove any lint or dust around the stylus to prevent any distortion in the sound.

Turn the volume control halfway up and lightly touch your thumb to the stylus. You should hear a scratchy sound from both speakers. A defective stylus should be replaced with one of the same or better quality. The stylus will usually slide out from the cartridge body.

Also determine if one channel may have a broken cable. Remove both phono plugs from the bottom of the changer. Then, remove the platter again and look for wires or cables from the cartridge.

Grasp the small metal plug ends of the cable. If you hear a loud hum from each cable, you may assume the amplifier is okay. Weak or no hum may indicate a defective audio channel in the amplifier. If the amplifier appears normal (with radio or other input source), check the cartridge itself for a broken wire.

Finishing up

Before you close up the turntable, don't forget about proper lubrication. Squeaky noises, slow speeds and erratic cycling of the turntable may be caused by improper lubrication. Look for old, gummed-up grease upon the cycling cam and draw bar.

Dry bearings of the idler wheel or turntable motor may produce squeaky noises. Gummed-up oil around the motor bearings may cause slow speeds.

Most changers are never lubricated until trouble occurs. A good cleanup with proper lubrication may be all that's needed to make that turntable sound new again.

FM



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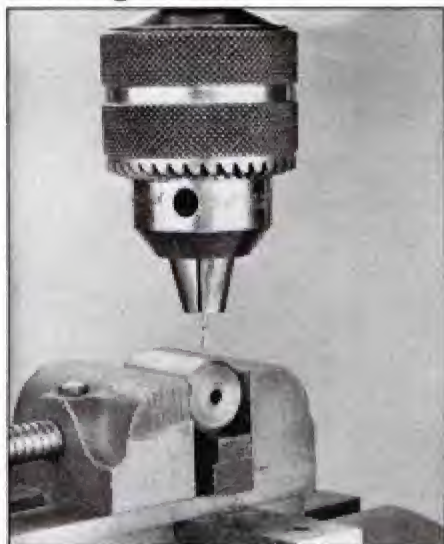
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HINTS FROM READERS

Starting a drill



When boring holes in metal the point of a small-diameter bit often wanders off the mark because of the bit's flexibility. To reduce this tendency, chuck the bit so that only a small portion— $\frac{1}{4}$ to $\frac{1}{2}$ in.—projects beyond the chuck jaws. When the hole is about $\frac{1}{8}$ in. deep, rechuck the bit in the regular manner. Don't subject the shortened bit to side stress.—Walter E. Burton

Table saw safety



Making a deep bevel cut in a small workpiece on a table saw can be a hairy experience. When the work permits, partially drive two nails to serve as handles. Stand on the side of the saw facing the fence and grasp the work with two fingers of each hand straddling the fence.—Rosario Capotosto

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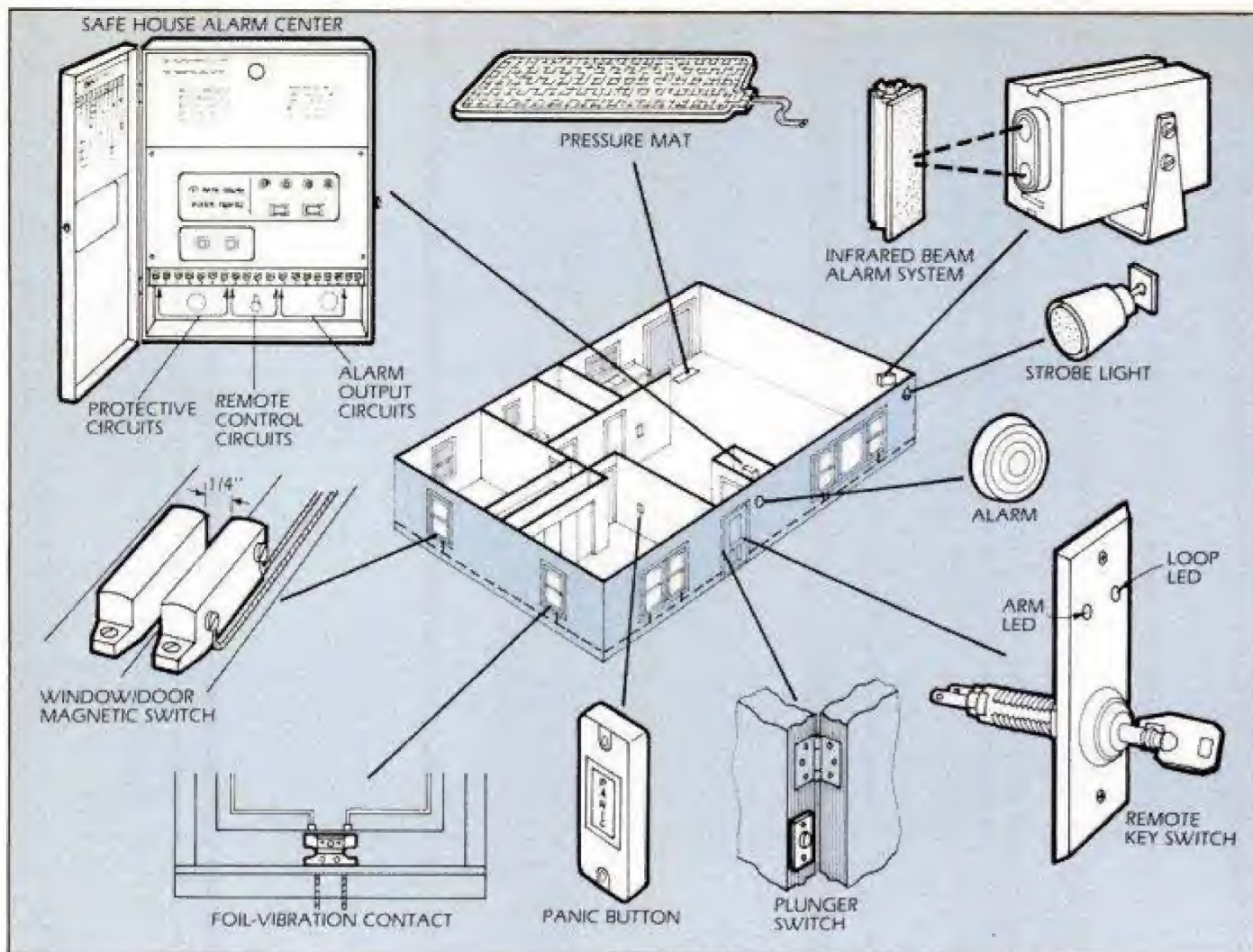
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Design And Install Your Own Burglar Alarm System

With this alarm system brain, you can add all types of intrusion detectors to guard your house.

BY DAVID PETRAGLIA

A really complete burglar alarm system for a large house can cost between \$1,000 and \$3,000 if a professional installs it. However, the basis for a pro-quality, do-it-yourself system can cost as little as \$129 from Radio Shack. With add-ons, it can become as complete as any you can buy.

The Safe House Alarm Center, No. 49-450, is the heart of Radio Shack's \$129 kit.

It includes four magnetic door/window sensors, an alarm horn, a remote key switch and 100 feet of twisted wire. This is enough to get you started by protecting the front and back doors plus two windows. Most homes will require

the purchase of additional sensors at about \$8 each.

Safe House sets off an alarm when anyone attempts an unauthorized entry into the protected building. It also lights a warning LED to indicate it's been tripped. The system works with almost all intrusion-sensing and alarm-sounding devices, and can operate a telephone dialer to call the police, a security service or another telephone when the alarm goes off.

The system works with two trigger loops or circuits: One sounds an instant alarm; the other goes off after a timed delay. If you trip it accidentally, the delayed alarm gives you a chance to shut it off before sirens scream or the

police are called. It also lets you come into your own home and, by knowing exactly where to go and what to do, shut off the system.

Instant alarms are useful for panic buttons or tamper switches. Tamper switches set off the system if a specific object, such as a valuable painting, is moved. Alarms can be noisy with flashing lights, silent calls for help, or both.

Delayed and instant alarms both operate on either normally closed (N.C.) or normally open (N.O.) circuits or loops. Separate circuits for N.O. and N.C. devices are activated when the sensor either closes a normally open

(Please turn to page 69)

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BURGLAR ALARM SYSTEM

(Continued from page 66)

circuit, sending current to the main panel, or opens a normally closed device, stopping the flow of current to the panel. Sensors for many different requirements are available for both types of circuits.

Normally closed loops are considered "supervised" because, unlike N.O. loops, cutting the wires sets off the alarm. Cutting the wires of an N.O. loop defeats it. To defeat an N.C. loop, you have to bypass the sensor, which is tougher to do.

In addition to N.C. and N.O. alarm trigger loops, there are a number of other features that help make an alarm system easy to live with and more protective. Battery backups take over if the current fails or the lines are cut. An automatic alarm resetter rearms the system if the intruder shuts the window through which he entered or otherwise returns it to normal. This won't stop the alarm from sounding the first time, but does reset it so it will sound again when he leaves or trips another sensor.

Remote arm/disarm control circuits allow you to set or unset the whole system from up to 10 locations. Entry/exit delay can be adjusted for up to 45 seconds to get you into or out of the house without sounding off. A pre-alarm circuit runs a buzzer or flashing LED warning light to remind you to turn the system off or to tell a knowledgeable burglar to get out before the alarm sounds. A 1-amp., 12-v. output runs the alarm on batteries if the power lines are cut. Pushing a button on the control panel indicates battery condition.

Indicator lights in the form of loop LEDs tell you when all sensors on that loop are normal. This allows you to shut the window before arming the system or tells you that it was tripped while you were gone. Another LED indicates when AC power is on.

Custom-designed system

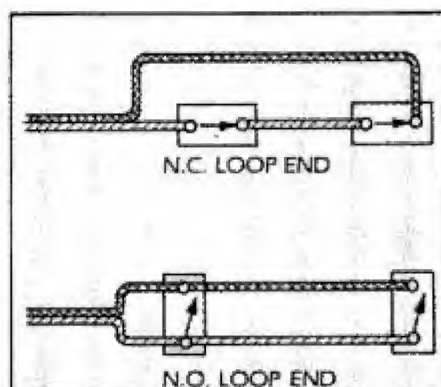
From these features in the control panel, you can see that each system can be custom designed to fit your home. One real advantage of a do-it-yourself installation: You can modify the overall plan to suit your own ideas and needs. Chances are your system will be different enough from most professionally installed units so that burglars won't be able to second-guess it easily.

When it comes to planning the system, your first step is to make a map showing all doors and windows. Then, photocopy it. Your system may end up being quite complex, and having a simple map to develop each loop makes it much easier to plan your installation. When your system is complete and operating, put one master copy in your

safe deposit box and destroy all working papers.

Given a sophisticated central panel like the Safe House, you can start with an area motion detector for quick protection. Then, you can wire door and window sensors, telephone dialers, backups, panic buttons pressure mats at doorways and other items to complete the system as time and money permit.

Since the central control panel is the heart of your alarm system, locating it is your first consideration. There are two schools of thought. One, put it out in the open to deter burglars who see it, and where, like the safe in the store window, anybody can be seen working on it. The second is to hide the panel so burglars can't find it easily to attempt to deactivate it in a hurry. Many alarm installation professionals prefer an unobtrusive location, such as in the front



N.C. (normally closed) and N.O. (normally open) circuits protect doors and windows.

hall closet. The added protection of a door sensor helps secure it.

Conceal the wiring for both esthetics and security. Of course, the easiest way is to build it into a new house. But in most cases, the best bet is to hide the wiring behind baseboards and door or window trim without having to open the walls. Drapes may cover wires leading down from windows. Otherwise, you're going to have to fish wires through walls and bore through 2×4s to install and conceal your system.

Door and window sensors come in many varieties for N.O. and N.C. loops. Magnetic switches, with the magnet on the moving section and the switch with its wires on the frame, are among the neatest and most effective.

Foil tape on the glass is unsightly, but it tells the world your home has an alarm system. Tape protects fixed windows and can also be used on movable windows and doors in conjunction with a window/foil/vibration contact. These trigger when the glass (and thus the foil) is broken or when the door or window is moved.

A plunger switch, like the one for the courtesy light in your car or refrigerator

door, works with swinging or sliding doors or casement windows. It mounts in the hinge side of the frame and is hidden when the door is closed.

Glass breakage detectors attach directly to the pane. Some of the latest types detect the sound-wave frequencies of breaking glass to activate the alarm. Open spaces in your home can be protected by motion detectors or pressure mats. The mat goes under the rug and sets off the system when somebody steps on it, usually by coming through a doorway or up a staircase.

Checking for movement

Motion detectors work in different ways. Ultrasonic devices send out high-frequency sound waves and listen to the pattern of reflected waves. Any change in the pattern caused by someone moving through the protected area sets off the alarm. Infrared devices do the same thing with infrared (heat) waves. These must not be aimed at radiators or heating ducts, which could trigger false alarms. Microwave devices work on radio waves. Plan to exclude family pets or aim motion detectors above them.

Vibration detectors activate on impact or vibration on any surface. These are usually N.C. devices and have adjustable sensitivity. Attach them to protect specific objects. There are many other devices that can also be wired into your system. Smoke detectors are a useful addition.

You also have a wide choice of output devices. A silent alarm like a telephone dialer calls for help to a security company on contract, police station (if possible in your location) or any other third party. These can be useful outputs for panic buttons or a confrontation with an intruder. Setting off an audible or visible alarm when confronted is not recommended. The intruder may panic and attack you.

Besides silent alarms, you can hook up bells, sirens and strobe lights. These should be installed on the outside of the building, high enough to be out of reach, and protected against tampering. As a general rule, locate these at least 8 feet high and 1 foot from the top of a door or window. Higher and farther locations are better. A protective grid, in addition to the metal box shielding the alarm from weather, is a good idea. A tamper switch wired into the tamper/panic loop is also advised.

A bell or siren alerts your neighbors and should cause most intruders to flee. A strobe light in addition to the noisy alarm can help police find your house more quickly when responding.

When you build your alarm system around a sophisticated central panel, like the Safe House, there are few limits to how far you can take it. **FM**



All the items here—the gavel, mallet, candlestick and lathe chisel handles—were turned from stock found in woodpile.

Look What Came Out Of The Woodpile!

That seasoned hardwood in your woodpile is just as good for turning as it is for burning.

TEXT AND PHOTOGRAPHS
BY RALPH WILKES

According to recent figures, nearly 25 million American homes have facilities for burning wood. And that number is increasing. Of those millions of people, how many have ever thought of their woodpile as something besides a source of heat? The home craftsman who has a lathe should, because he can find in this fuel a high-quality and economical source of woodworking stock.

The major requirement for good lathe material is the same as for burning: Wood must be dry. The best turning stock and the best firewood come from logs cut during the dormant season and dried—off the ground—for at least one year and preferably two years. Wood that has been sawed and split to size for a woodstove or fireplace will dry the fastest.

For my own wood-burning use, I buy seasoned hardwood. Then I select some pieces for turning and dry them further inside my house, where the temperature and humidity remain relatively constant. This reduces much of the checking, or cracking, that temperature and humidity fluctuations can cause at



Use a maul to drive a steel wedge into the widest crack in the log end. This will split the wood where nature intended.



Cut lathe stock from log using slow feed rate. Otherwise, the rough log edge may cause binding between fence and blade.



Split faces show contrast between dark heartwood and sapwood. Choose turning stock based on color you desire.



A little lathe work will turn a piece of cherry firewood into a gavel head. French polish finish brings out the grain.

the end of a log. Sometimes, I find walnut or cherry in a wood delivery, pieces which were probably left in the woodlot after a commercial lumbering operation.

When I want to use some of my dried reserves, I split the logs with a wedge and maul, and then cut them to size on my radial-arm saw. A band saw or

table saw would work just as well. Once I've squared the piece, I insert it into my lathe and I'm in business. I finish most pieces with a simple French polish—boiled linseed oil and white shellac—rubbed with a rag onto the piece as it turns in the lathe. For safety, remove the toolrest before applying the finish.

PM

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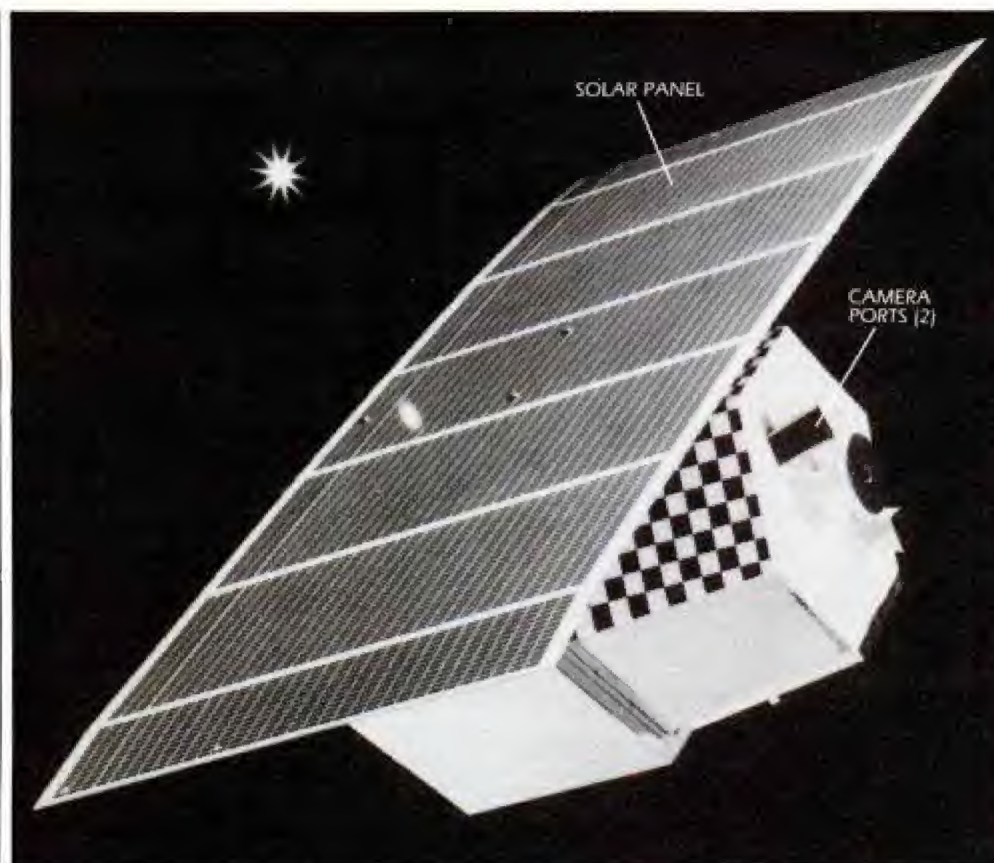
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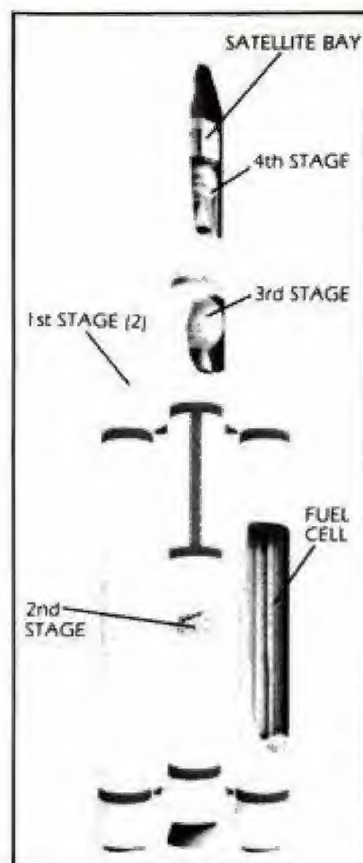
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Dept. X4



Artist's concept of Space America's Landsat-type satellite shows large solar panel which generates electricity to run two cameras mounted so that they're shielded from direct sunlight.



Conestoga II rocket uses four solid-fuel stages to lift the satellite.

First Private Space Taxi

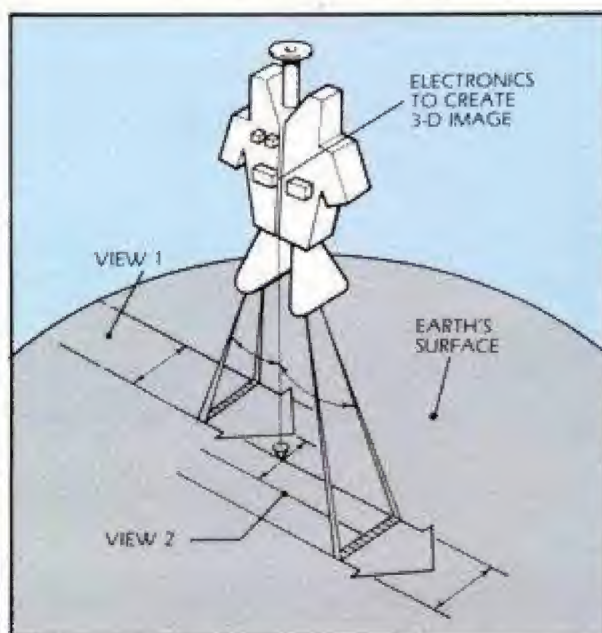
Standing alongside a Space Shuttle, the Conestoga II rocket would hardly look impressive. It's less than one-eighth the length of the Shuttle, and delivers a 945-pound payload, about 1/60th of the Shuttle's capability. Still, the new rocket is the talk of the aerospace community. About 15 months from now, the Conestoga II will become the first privately owned vehicle to place a privately owned and operated Landsat-type satellite into orbit.

The rocket is an advanced four-stage version of the two-stage model test-fired over the Gulf of Mexico last year by Space Services Inc. It will be the centerpiece of a new joint business venture. Former astronaut Deke Slayton is one of the principal officers. Space Services has joined with Honeywell, Thiokol and Ball Aerospace, all of whom have begun the design work to put together the Landsat package. The conglomerate calls itself Space America.

Slayton says the first launch will cost about \$30 million. The

In about 15 months, the first privately owned rocket will fire a satellite into low Earth orbit.

BY JACK MESSMER



Two cameras will be used to send 3-D photos back to Earth through a system of electronic and fiber-optic devices.

rocket will use solid fuel in each of the four stages. A pair of Castor rocket engines will serve as the first stage.

The satellite itself—which will explore the Earth for oil, minerals, water and other resources—will be similar to the current four-mirror Landsats in low Earth orbit. But the new package will use a pair of cameras and advanced electronics packages to produce the first 3-D Landsat images. The images will cover areas about 90 miles wide, comparable to NASA's four operating Landsats.

When America's Landsat program started in the 1970s, it was supposed to be a 10-year Commerce Department experiment. For the past two years, NASA has carried Landsat on its budget, hoping private industry would take over that function. Space America officials say they may buy existing orbiting Landsats. The conglomerate will sell its Earth resources images to oil companies, real estate developers and government agencies. **PM**

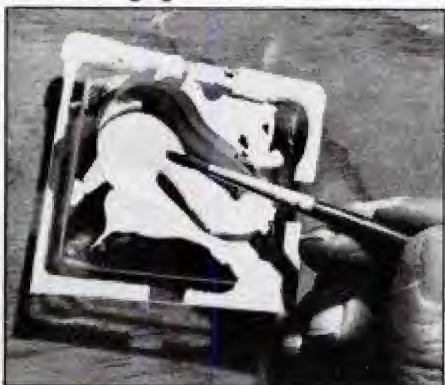
HINTS FROM READERS

Sealing inaccessible places



When you need a dab of panel adhesive or caulk in a spot that a caulking gun can't reach, or when your gun isn't handy, use a putty knife. Pull off the back cap of the tube. Scoop out the amount you need with a putty knife. Cut off the excess cardboard with tin snips and reinsert the back cap to keep the remaining material from drying. With the back cap on, the cartridge can still be used in the gun.—*Craig Wilson*

Touch-up paint container



Save a few of the plastic covers that protect articles mounted on cardboard. The covers make excellent containers for small amounts of paint used in touch-up work. You can throw them away when the job is completed. Many covers have more than one level of indentation, which makes wiping excess paint off the brush much easier. Easy access and a no-stick surface mean no paint wasted.—*E. V. Reyner*

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PM's Outdoors Editor hangs from the one-man Cloudhopper, supported by a plastic seat. A propane fuel tank is strapped to his back.

Now: Backpack Ballooning

PM editor tests new one-person, hot-air balloon.

BY RAY HILL; Photographs by Fred Milkie Studios

Power lines are dangerous," Tony Chace was telling me. "If you get the balloon hung in one, don't let your feet touch the ground. We'll get the power company to shut off the electricity, then get you down." I nodded, hoping I wouldn't need his advice.

Tony is a commercial hot-air balloon pilot. He was instructing me on how to fly the Cloudhopper, a single-person

balloon recently imported to America from Europe. The Cloudhopper is a lot different from an ordinary hot-air balloon. It weighs only 150 pounds and holds 21,000 cubic feet of air. That sounds like a lot of air, and it is. But a normal-size balloon that can carry two or more people may hold more than 100,000 cubic feet of air.

You can transport the Cloudhopper

in your car. With a conventional hot-air balloon you need a trailer, van or truck to carry it. The Cloudhopper is cheaper, too—only \$5,000, versus \$15,000 and more for a conventional balloon.

The other big difference is that a Cloudhopper pilot straps a 10-gallon propane tank and burner on his back—another reason why calm air is particularly important. Trying to land in a

strong wind with all that hardware on your back could provide all the excitement you would need for one day, considering that your legs are the landing gear. The burner with a full tank of fuel weighs almost 100 pounds.

For three days we tried to launch the Cloudhopper. And for three days we failed. The wind was too strong. Wind can do nasty things, such as blow the balloon into power lines and trees during landing.

On the evening of the third day, we stood in the middle of a big, empty field. It was 7:00 p.m. and the wind had died down. There was just a barely perceptible breeze.

Tony looked at me. "How do you feel?" he asked.

"Let's do it," I said, with a lot more conviction in my voice than I felt.

"Okay, gang," Tony said to our crew. "Let's set it up."

Parachute for security

While the crew assembled and inflated the balloon, I strapped on a parachute. The parachute was a safety device. If a problem developed, I could cut away from the propane tank strapped to my back. A static line would automatically open the chute. It seemed like a good idea. But nobody had actually tried it. I hoped I wouldn't be the first.

In previous tethered flights, I had used a different harness that had no parachute. Its only amenity was a little plastic seat, but that hurt my hips because it was too narrow. If nothing else, the parachute harness gave me a sense of security.

With the old rig, if a problem developed—say, you ran out of fuel—and the balloon started plummeting, you would be strapped to the propane tank and would go down with the balloon. Unfortunately, there was a drawback to the parachute harness—which I didn't know about yet.

Ten minutes later the crew had the balloon inflated. Tony gave the burner an occasional short blast—enough to keep the balloon vertical, but not enough so the crew members couldn't hold it down.

I walked over to the balloon and attached myself to the propane tank, which gave me a very strange feeling. Not being in the habit of strapping fuel tanks on my back, I felt a bit like a laden-down Buck Rogers.

"It's been nice knowing you," one of the crew members said. Great sense of humor. I reached up with my left hand and grasped the burner lever.

"Whenever you're ready," Tony said.

"Let her go," I told him. The crew let go and I gave a tug on the burner lever. There was a loud roar just above my



Hill practiced tethered flying until he could make stand-up landings. Walking inside the balloon (below), he inspects the envelope before tethered practice.



head as the burner sprang to life.

The balloon shot straight up with surprising speed. In only seconds I was several hundred feet off the ground. I gave the burner about a four-second blast. I wanted to get up high so I would have a good look at the countryside.

After a few more blasts, I was at what I estimated to be about 1,500 feet. I could see the countryside for miles around. With the burner off, the only noise was the pilot light burning quietly over my head. Suspended from the balloon in my harness, I had nothing under me but air.

Hanging high above the Earth, floating silently along with the breeze—it was a strange and exhilarating feeling. It was also a bit unnerving. Suppose the pilot light went out and I couldn't get it relit? It had gone out when I was on a tethered flight a few days earlier. Perhaps a gust of wind blew it out. We never knew the cause.

Pressing a button above my left shoulder several times finally got it lit. Pushing the button bends a quartz crystal which is connected by a wire to a sparkplug. When the crystal bends, it creates enough voltage to jump the sparkplug's electrodes and ignite the pilot light.

But suppose it went out now and wouldn't relight? The pilot light and burner were above my head. I couldn't see them. If pressing the button wouldn't do the trick, I would have to use my parachute. There was no other choice.

No use worrying about something that may not happen, I decided. Relax and enjoy the view. And what a view it was. I was drifting down a valley bordered on either side by hills covered with trees. Houses were small, and people even smaller.

There were farms, small squares of green dotted with trees and houses. Underneath me, a farmer was on his tractor spraying his corn, oblivious to me and my balloon floating by quietly, high over his head.

Harness problem

My left leg was beginning to go to sleep. I moved around in the harness a little to see if that would help. It didn't. The harness was cutting off circulation in my legs.

I had been giving the burner intermittent blasts, spaced far enough apart to keep me flying level at about 1,500 feet. I increased the time interval between blasts and the balloon started falling.

My chase crew was in five separate vehicles. They had been following me since I took off. A chase crew's job isn't easy. They must keep their eyes on the

(Please turn to page 115)



Coming in for a landing, Hill is all smiles. Pulling on the red strap in his right hand opens a flap in top of balloon, letting the hot air spill out.



Balloon pilot Tony Chace gives Hill instruction on operating burner. Pulling lever with left hand ignites burner. Pilot light burns all the time, but burner is used only intermittently. At left, Hill practices balloon walking. He flies the Cloudhopper high enough so he can walk on a conventional-size balloon.

Vantastic!

Why leave the office when you can take it along?
Our van is packed with the latest in electronics
so you can work on the run.

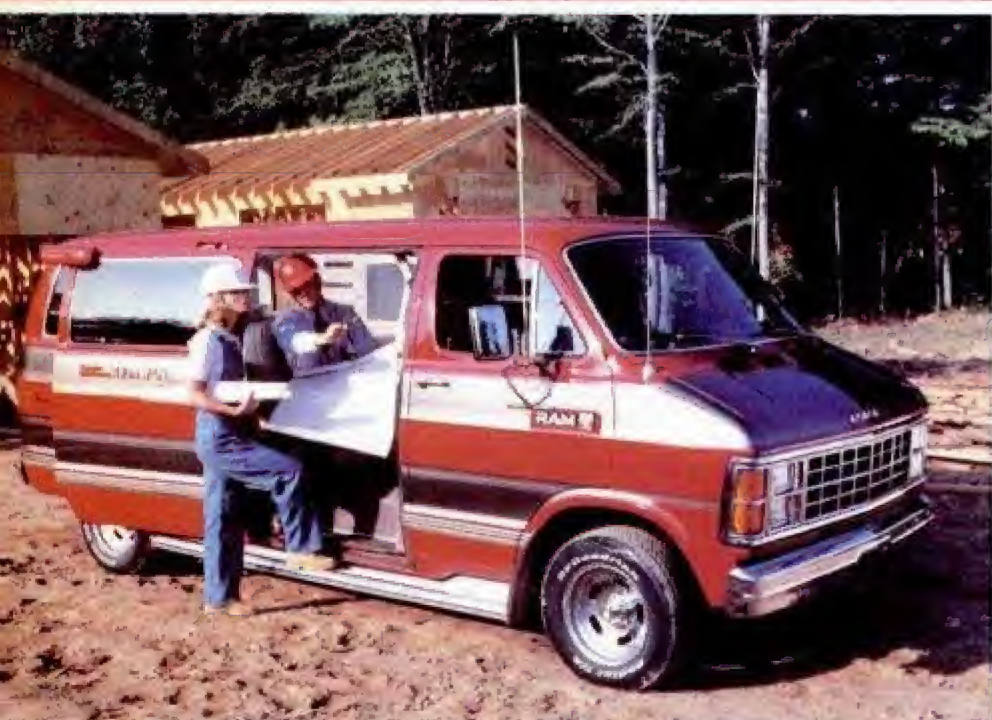


An office on wheels is not exactly a new idea. Julius Caesar's mobile office was a chest carried in a cart, Napoleon's was built into a carriage and Cornelius Vanderbilt had one that occupied a whole railway car, complete with telegraph-operated stock market ticker. In each case, the purpose was to keep up with business, despite the necessity for travel.

You might not be running an empire or a railroad, but there are still times when being able to do office work out of the office could be a lifesaver. Thanks to today's inexpensive,

miniaturized electronics, you can fit a highly sophisticated electronic office into just a few square feet. And it can communicate with any person or computer anywhere in the world, even while you're moving. It's just one step down from Air Force One.

As our society becomes more communications-conscious and more dependent on computers, we think the concept of the mobile office with computer capabilities will become commonplace. With this in mind, we gazed into our crystal ball to see what a mobile office might look like. But



Office-equipped van is ready to work, even when you're in the most out-of-the-way places.



the amazing part of our project is that we used equipment available right now. So, in reality, it's a thing of the present, not the future.

We designed our Mobile Office to take advantage of low-cost, readily available electronic components that you can buy locally and assemble yourself. We fit the equipment into a common full-size Dodge window van—still the most efficient packaging of space. But the office is compact enough to fit into a variety of vehicles, from a limousine to a corporate jet, from a pickup truck to a cabin cruiser. With some modifications, it would even fit into one of the new downsized vans just introduced by Chrysler and Toyota.

The heart of our electronic office is an Apple II Plus computer. To feed



The interior of our van (above and below) features top-notch electronics. Apple II computer with 48K is further enhanced with a Saturn 128K card, Hayes Micromodem and Epson MX-100 printer. Zenith's component video system includes source selector, amplifier, tuner and monitor, as well as videotape deck. We put them all together for the best in on-the-go workstations.

the Apple, we have dual Apple II 5.25-inch disk drives, with an Apple disk interface card to link the computer and drives. An Epson parallel interface card connects the Apple with an Epson MX-100 printer for hard-copy printout, and a Saturn memory card expands the Apple II to 128K. Videx supplied an 80-column Video-term card to expand the Apple's on-screen performance.

Rather than equip our Mobile Office with a simple CRT, we opted for the greatest possible versatility—a Zenith Model 1200 Video Director VCR with component television system. What really makes this whole concept work is the combination of a Hayes Micromodem II and a Motorola Pulsar II mobile telephone. This allows the computer to interface with



any computer information network accessible by telephone modem, as well as a corporate mainframe computer back in the office. You really can access the whole computerized world while rolling down the highway.

Installation was a bit more complicated than in a stationary office. Preliminary sketches showed that we could fit the whole system into less than 5 feet of wall space and still have an ergonomically correct layout—that is, one designed to position components for the most comfortable use. Thus, the keyboard is in the center, video equipment to the left and disk drives and printer to the right.

Master machinist Ralph deMasi constructed a framework of 1-inch-square,

automatic transmission and all the normal options. But, of course, we customized it to suit our own purposes. We fitted B.F. Goodrich 235/60R15 Radial T/A tires on 15×7-inch wheels, and added heavy-duty Monroe shock absorbers.

On the inside, we installed a Radio Shack Realistic 40-channel CB and an Alpine Model 7347 AM/FM/cassette radio. This topline unit features Dolby B and C noise reduction circuits, electronic tuning and a 10-station preset memory. Alpine also supplied two 50-watt-per-channel amplifiers to feed four EPI LS-70 speakers.

This left us with a stock Dodge van filled with electronic gear. Nice, but not special. For special, we went to Vandal-

Bivouac's topline Signature series.

Darker gray fabric in a herringbone pattern is used over the CB, engine cover, door inserts, sun visors and along the entire length of the overhead console. The reading lights in the console can be turned off and on individually, or in pairs from a master switch and fuse housing within reach of the driver. The generous map packets in the seat backs are a handy place to store VCR cassettes and the TV's remote controller.

Our Mobile Office is unique—a one-off dazzler at the very forefront of electronic ingenuity. And yet the only custom work in the entire vehicle was the scratch-built frame to hold the computer and video equipment. Every other part is available over the counter and



All of the components were installed in framework of 1-in.-sq. mild-steel tubing.



A pair of deep-cycle marine batteries nestled behind the couch runs the electrical gear. Note flex hose vents.



Mobile phone and a modem let us interface on the run.

mild-steel tubing, arc-welded together. This was bolted to the floor of our van. Then the various video and computer components were bolted to it. All exterior surfaces were sheathed with brushed stainless steel, held in place with Southco quick-release fasteners and pierced with cooling louvers on the cabinet back.

To run the equipment off the van's electrical system, we used a 12-volt d.c. to 110-volt a.c. inverter with line-surge filter. The inverter, in turn, is powered by a pair of deep-cycle marine batteries mounted at the very rear of the van, behind the couch. Each battery is secured inside a waterproof marine case and vented to the outside through flexible hose. These batteries are charged by the van's stock heavy-duty charging system. There's also a land line that can be plugged into a 110-volt a.c. outlet when that's available.

Then there's the van itself. We ordered a 127.5-inch wheelbase Dodge Custom Ram Wagon with B250 suspension. The van has a 318-cubic-inch V8,



Circuit breakers and aircraft-style swivel lights are mounted in the ceiling console.



A Realistic 40-channel CB console also is covered in the businesslike gray herringbone.

ia, Mich., home of Bivouac Industries. Bivouac Chief Engineer Del Littrell designed a custom interior to fit around our electronic office. Based on Bivouac's Roamer package, it has subtly striped gray velour walls and ceiling, courtesy lights in the doors and aircraft-style swivel lights mounted in a full-length overhead console.

Across the back of the van Bivouac installed a gray leather couch for three, matched by swiveling executive chairs in the office and driver's compartment. These seats are immensely comfortable and attractive—the highlight of our mobile office interior. They are from

required only a little innovative thinking to be adapted to new uses.

But the beauty of the Mobile Office is its versatility. With the right software, it would make a terrific on-site office for an architect or construction engineer, a mobile showcase for a real estate broker, a convenient presentation room for a traveling salesman or the ultimate commuter vehicle for a busy executive who can't afford to be out of touch with what's going on. Think about it. If Napoleon's office on wheels had been as good as ours, you might never have heard of a little town in Belgium named Waterloo. **PM**

Produced by the PM Auto and Electronics Depts.
Text: Rich Taylor
Photos: Bill Ashe
Fabricator: Ralph deMasi
Interior design: Bivouac Industries

Programs That Make Learning Fun

These exciting, educational programs can make any child happy that he's living in the computer age.

BY NEIL SHAPIRO, Electronics Editor
AND HERB FRIEDMAN

A *Ernie's Quiz* features a program to let kids design faces on an Apple II screen.

B *Bumble Games* teaches about number lines and two-dimensional plots using Apple II.

C *Beginning Grammar* animates words and phrases for the young user of the TI-99/4A.

D *Micro Mother Goose* moves classic nursery rhymes into the computer age with a clever mix of graphics and games for the Apple II.

The most rewarding and exciting experiences for young children often occur the day they first understand why two plus three equals five, or discover that "cat" is the word for the family pet, or can tell direction by north, south, east and west.

For some children, it all comes naturally. One day you discover they can do arithmetic, spell or even know the capitals of 10 states, or maybe all 50. Other children need a little help—extra practice with letters or numbers, more experience with special concepts, perhaps some color, sound and action.

Regardless of what's needed, the computer can do it and make it fun. A computer can teach the alphabet while entertaining a preschooler with song, build vocabulary using action graphics and teach spatial concepts through games. It can even provide a mess-free way for a child to paint pictures by using an electronic paintbrush.

Fun-for-kids educational software is available for most personal computers. Some programs are available as plug-in modules, others as cassette tapes or floppy disks. Module software has the

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E *Mix and Match's* animal quiz for the Apple II challenges kids to guess what animal is on the computer screen.

F *Stickybear ABC* features superb graphics and is designed to teach preschoolers the alphabet. This Apple program includes a bound storybook.

G *States and Capitals* will have Atari youngsters thinking that even geography can be fun—as long as they can learn it on a computer.

Space-Age CROSSBOWS



PSE Crossfire

This compound bow has pulleys that increase power and aid cocking. The 125-pound prod (bow) drives bolt at 250 feet per second. \$666.

Crossbows were once awkward medieval weapons of war. Today, modern engineering and space-age materials have transformed them into light, accurate, powerful pieces of archery equipment. They're fun. And they're easy to use.

With a high-tech crossbow, you stand a good chance of getting a bull's-eye the first time you shoot.

Modern sport shooters find the crossbow has many advantages over even the most modern conventional bows. Its drawbacks—slow reloading time, bulkier shape and weight—are compensated for by its virtues: staying cocked for precision aiming, accurate sights and ease of learning. The latest designs take full advantage of the plastics, composites and compound linkages developed for pull-'em-back-and-let-fly standard bows.

Finding a place to shoot a crossbow safely is a snap compared with locating a firearm shooting range. There's virtually no noise to draw attention to your activities or annoy the neighbors. You will need an archery target to catch the bolts (crossbow arrows are called bolts). The side of a garage or an earth embankment stops bolts that miss the

target, but once you get used to your bow there should be very few of these.

The myth about the crossbow is its extraordinary power. (The state of Michigan once even listed crossbows with cannons and machine guns as banned weapons.) In actual use—in both ancient and modern times—crossbows have been no more powerful than longbows.

Depending on the force developed by the prod (bow), crossbows produce velocities that range from about 150 to 250 feet per second (f.p.s.). One of the most powerful that we tried, the PSE Crossfire, hurls a 500-grain bolt (about 1 ounce) 250 f.p.s. It sank these 22-inch-long, arrow-like bolts up to the plastic guiding vanes in a standard archery target. The little Trident pistol-crossbow sank its baby 6½-inch, 350-grain bolts 2 to 3 inches into the target. Its 35-pound prod is about as much as you want to cock by hand for fun-type plinking or target shooting. A cocking lever is under development for it, and should become available shortly.

Before you can shoot a new crossbow, you must first assemble it. Bows come with instructions for

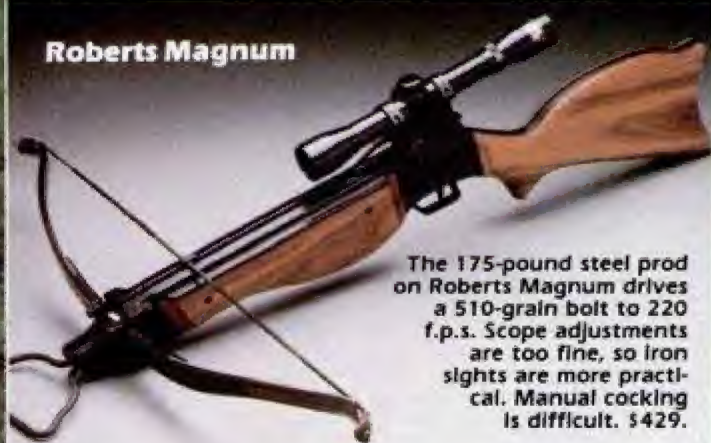
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With today's high-tech version of the medieval crossbow, you stand a good chance of getting a bull's-eye the first time you shoot.

BY ANGUS LAIDLAW



Roberts Magnum



The 175-pound steel prod on Roberts Magnum drives a 510-grain bolt to 220 f.p.s. Scope adjustments are too fine, so iron sights are more practical. Manual cocking is difficult. \$429.

Barnett Trident



Trident pistol crossbow sinks 6-1/2-inch bolts 2 to 3 inches into target. One-hand accuracy takes practice. \$99.

Martin 2550



This prototype compound has two separate limbs on its prod, which allow for accurate adjustments. \$425.

Barnett Supreme



Featuring goat's foot cocking lever, Supreme was among the best liked for sport shooting. \$324.

Barnett Commando



To draw string, Commando bends in middle. It's one of the easiest and most practical of the crossbows we tried. \$449.

PSE Foxfire



Foxfire sports same prod as Crossfire. \$333.

PHOTOGRAPHS BY BILL ASHE

IT'S A HIGH TECH CHRISTMAS

The playthings for 1983 are fast, lightweight, durable and often computerized. And they're fun!

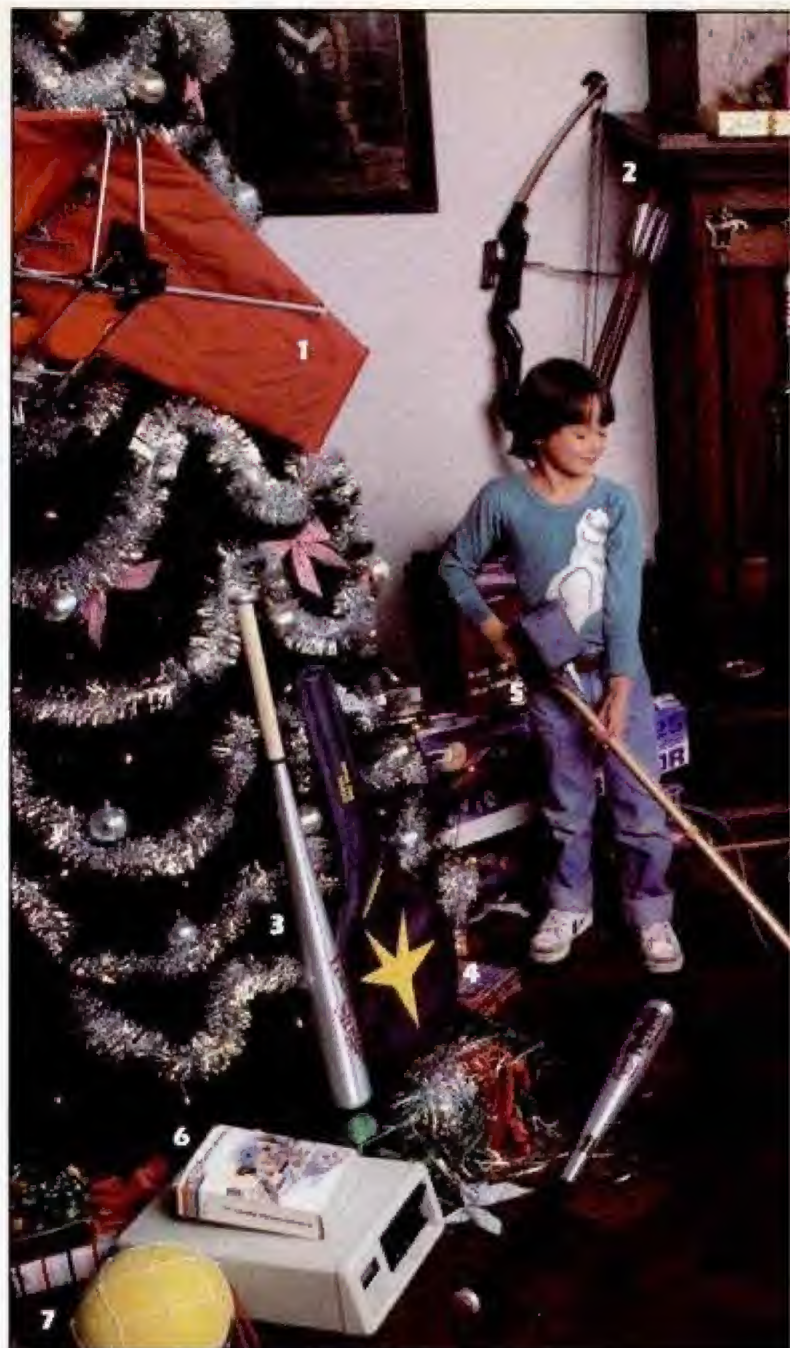
BY DENNIS ESKOW, Science Editor

The F-4 Phantom jet sits gleaming on the make-shift runway, its fan-jet engines waiting to be brought to life. Just a few feet away, sitting under the silvery Scotch pine tree, is a composite desert rover whose body is held together with special lightweight bridge struts. As we scan the horizon, we see electronic metal detectors, space telescopes and dozens of other objects made of the latest plastics, composites, circuit boards and optics. It's Christmas morning in America, and this year's holiday is expected to herald the entrance of some of the most sophisticated playthings ever.

"All the new technologies have trickled down to the play level, and the time has come when anybody can get his hand on the most outlandish stuff," says Bob Callandra of Polks, the New York catalog house for hobbyists. Some of the high-tech items are for experts only. The big Phantom jet, for instance, is a radio-controlled model that took expert Robert Ortega eight months to put together from a kit. Ortega, who flies his craft with the New York Blue Angels club, says it takes a skillful model-pilot to operate the \$2,000, 19-pound craft. It soars to 500 feet at a true groundspeed of 100 mph.

Much of this year's high-tech gear is for sports enthusiasts. Kneissl, for instance, is selling a new line of graphite, Kevlar, boron and fiberglass rackets with adjustable heads that can shift the sweet spot as you change partners or playing surfaces. They sell for \$300 at pro shops. At a lower price, tennis buffs can enjoy light weight and durability in the new Prince composite rackets. Mitsubishi's golf-swing analyzer will help your swing for \$250.

Some traditional playthings have taken on a higher tech look this year. For example, the Erector set, which will celebrate its 70th Christmas, now comes with remote control and composite futuristic vehicle body.

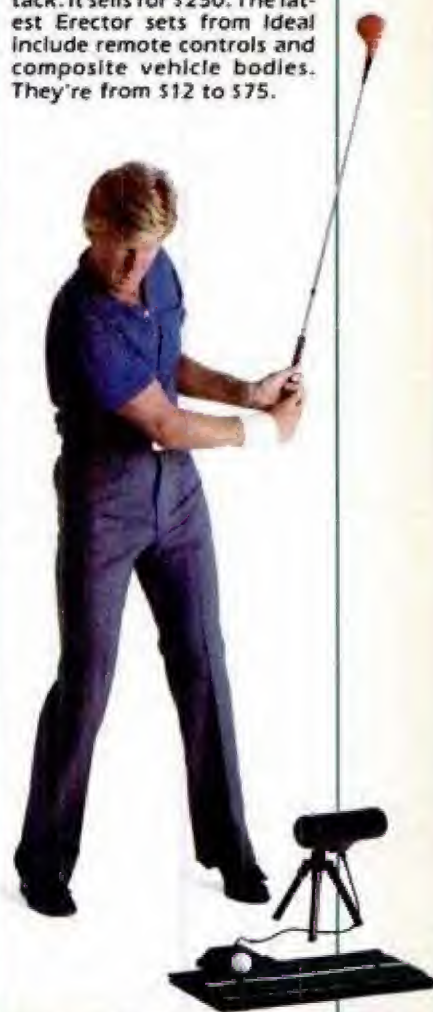


The Minox E.C. spy camera is from Edmund Scientific. It has a battery for the built-in flash and a roll of special 15-exposure Minox color film. The camera costs \$200. Pre-

paid processing pack costs \$9, including the film you get when exposures are returned. Four-element optics produce better-than-average snapshots.



Radio-controlled ultralight from Polks New York (1) comes assembled for \$300. Baco's composite bow and arrow (2) at \$200 is for target shooters. New bats from Louisville Slugger (3) include models with wood handles and aluminum heads. The latest tennis gear from Kneissl features adjustable head and composite frame (4) for \$300. Fisher M-Scope metal detector (5) could pay for itself at \$332. It detects metal to over a foot underground. The latest in home computer equipment is the hard-disk drive (6). Gemini model shown lists for \$4,000. AMF's indoor soccer ball (7) is made of composites and costs \$17. For under \$800, you can own a radio-controlled submarine (8) from Polks with a CO₂ fired torpedo tube and water ballast tank for submersion down to 6 feet. Radio-controlled F-4 Phantom (9) costs \$2,000. Bausch & Lomb's Criterion 4000 telescope (10) lists for \$595. Mitsubishi's golf-swing analyzer (below) measures your swing's strength and angle of attack. It sells for \$250. The latest Erector sets from Ideal include remote controls and composite vehicle bodies. They're from \$12 to \$75.



IT'S A **HIGH-TECH** CHRISTMAS

CRITERION 4000



The Criterion 4000 telescope, a Schmidt-Cassegrain type, has powerful optics enclosed in a lightweight plastic body. Just add a camera to the rig and an observer can get the sharpest images over the widest possible field. This is a perfect scope for capturing the beauty of distant stellar nebulas. It's also first prize in PM's Space Shuttle contest (*Put Your Own Project On The Space Shuttle*, page 102, Apr. '83). Other good telescopes are available on order from Edmund Scientific or through optics dealers in your area. This Christmas, Hammacher Schlemmer is introducing a new portable telephone. The \$299 **Clearrest Tone** phone has a pushbutton volume control and a loudspeaker box for conference calls. Digital is the word for the day with the latest high-tech exercise gear. Typical is the **Vitamaster** Industries exercise bike, which features gradual gear control to adjust the amount of force needed to work the pedals. On the bike's handlebars is a digital readout screen (far right) and a finger socket with a sensor to measure the pulse of the person exercising. All you have to do is put your finger inside the socket and turn on the mini-computer and you're on your way to a monitored workout. The screen gives time of day, running time, estimated speed, estimated distance traveled, calories being burned at the moment and calories being burned per hour at the current rate of exercise. The mini-computer also shows the current pulse and average pulse for the entire exercise session. The bike costs \$320 plus shipping and can be purchased through sporting goods outlets. The advent of strong but ultralight-weight chrome-plated steel has made other major exer-

cise gadgets possible. The **Gravity Guiding System** (upper right) includes Chrome Gravity Guiding Inversion Boots (\$89.95) and the 1120 Gravity Guider (\$699.95). The system's frame stands vertical from 8 to 11 feet high. A vinyl-covered orthopedic canvas bed is roped to a swiveling frame within the system's overall frame. The



CLEAREST TONE PHONE



swivel frame can be adjusted to swing through a 360° turn with the exerciser strapped onto the bed. Insert the chrome boots into the central frame and you can turn the bed upside down and hang by your ankles. This stretches the spinal column and eases back pain. Scores of exercises can be performed on

GRAVITY GUIDING SYSTEM



VITAMASTER

the Gravity Guider, which is being used by American gymnasts training for next summer's Olympics in Los Angeles. The Gravity Guiding System also has a chinling unit (not shown) with extendable ends. Just pull out the ends and the bar hangs inside a door jamb.



NIKON MICROSCOPE

Now that companies like Nikon, Zeiss and Olympus are making microscopes for \$450 and up, the amateur can benefit from shopping around. The \$7,000 Nikon at left is for hospitals, labs and schools, but a well-heeled amateur could handle its computerized film exposure and advanced optics. To accommodate growing interest in biofeedback training, several firms are making devices to monitor pulse, respiration and galvanic response to your surroundings. These help you "train" your mind to control body functions. Thought Technology Ltd.'s \$360 Biofeedback 4 system is an outstanding unit.



THOUGHT TECHNOLOGY



ACTION GAMES



KNEISSL RACKET

Kneissl's high-tech tennis racket (left) is a Graphite body hollowed out with a composite rod in the handle that adjusts racket balance. Adjustment knob is at the bottom of the handle.



Among the biggest items on anyone's high-tech Christmas list are the latest action games. *Hard Hat Mack* and the *Last Gladiator* (both from Electronic Arts for Apple and Atari computers at \$34.95 each) are typical. *Mack* has an up-and-coming contractor fighting off vandals and building inspectors. *Gladiator* puts the player into one-on-one combat. *The Quest* (from Penguin Software for the Apple II at \$19.95) is one of the finest new adventure games. It features detailed screens, each another step toward solving a logical puzzle. The

old-fashioned science kits will be available in higher-tech versions this year. From Edmund Scientific, we have Chemistry 4 (\$46.95), with a wide selection of chemicals. Other sets include Biology-Life Science Kit (\$18.95), with well-preserved field specimens and the \$79.95 Electronic Experiment set that lets the builder make everything from an oatmeal-box radio to a tiny burglar alarm. Gilbert still puts out excellent science toys in a similar price range. Child psychologists warn that science sets are usually suited to children over 14. **PM**

SCIENCE KITS



THROUGH THE ICE!

Here's what happens when your car or snowmobile breaks through the ice—and how you can stay alive.

BY ED FALES; Illustration by Bob Dacey

Going through the ice is America's newest outdoor peril, as more sportsmen take to frozen lakes in cars, pickups and snowmobiles—and on foot.

It's midnight last Jan. 10 on Michigan's frozen Lake Murray. Two men on shore hear engines and are startled to see a parade of red tail-lights streaking away from land. Six sportsmen, all good friends, have gone out on an exciting snowmobile jaunt—and disaster. What the six don't know is that the wind has split the ice. Open water lies ahead.

The men on shore see the first red light vanish. One by one, the others disappear. The snowmobiles have followed the leader off the ice into deep water a quarter-mile out. Rescuers rush to help, but four men are dead.

It's 2:00 p.m. last winter on Minnesota's huge Mille Lacs Lake. Scores of fishermen are miles offshore in cars and snowmobiles. Suddenly, a winter storm kicks up. Headlights flash as all race for shore.

But these sportsmen aren't aware that even thick ice bends with the weight of each vehicle. And when a car moves on ice, the bending wave travels with it, creating a constant ice wave that may spread 100 feet in all directions. If other cars get too near, their waves cross. Result: a sort of riptide turbulence that can shatter even thick ice.

A plow has opened a road and at first the going is easy. But then, whether from the wind or the riptide, the road splits. There's an enormous splash and one car goes in. It hits bottom 25 feet down. Incredi-

With two professional divers inside, this Chevrolet station wagon is purposely driven onto thin ice. An insurance company staged the crash to learn more about what happens when a car goes through the ice, and to produce a film on water safety. The elapsed time between the first photo and the fourth is about two seconds. Drawing at right depicts what might happen in real life: Driver escapes through rolled-down window and swims to safety. Quick reaction is vital, so cold doesn't paralyze you.





It's 10:00 a.m. on Maine's frozen Minnehuit Pond. Crossing the ice in a blue 1976 Saab hatchback are young

An increasing number of accidents like these in the past three winters have safety experts worried. Minnesota has logged more than 100 sinkings, scores of rescues and over 20 deaths. Michigan and New York combine to add

But from such tragedies have sprung dramatic new investigations—and some fantastic discoveries that can save lives. The first is a growing awareness that many who drown could have been saved by a strange "deep-freeze" phenomenon, which every sportsman

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20 Always be prepared, the Army says, "to leave your vehicle in a hurry."—E.F.

WE TEST THE WORLD'S FASTEST SUPERBIKES

All four 1100-cc superbikes would do more than 130 mph. The question we went to El Mirage Dry Lake to answer was—how much more?

BY RAY HILL, *Outdoors Editor*

PHOTOGRAPHS BY VIC HUBER

I was hot inside my leathers as I made a U-turn and came to a stop. It was only midmorning, but already the temperature was scorching. The El Mirage Dry Lake bed, I decided, was not a very hospitable place.

But it is a good place to bring the world's fastest street bikes to learn their top speed. No speed limits. No police. And no traffic. Our four test bikes were the Honda CB1100F, Honda V65 Magna, Kawasaki GPz1100 and Suzuki GS1100 Katana.

Each of these motorcycles has an engine capable of producing more than 100 hp. And each weighs well under 600 pounds with a full tank of gas. That kind of power-to-weight ratio results in a vehicle that can out-accelerate virtually any production car in the world. All of these superbikes are capable of blasting through the lights at the end of a quarter-mile from a standing start in 11 seconds. The speed through the traps? A crisp 120 mph-plus. By comparison, a Ford Thunderbird Turbo Coupe takes about 17 seconds to go through the quarter at a speed of about 80 mph.

But how fast can one of these two-wheel rockets run if given its head? Don't stop at the end of a quarter-mile. Twist the throttle to the stops and let the engine spin until it can't turn any

With 108 hp on tap, the Honda CB1100 has more than enough power to loft the front wheel on command, as PM's Outdoors Editor demonstrates. All the superbikes we tested produce similar power. The big question was: What is the top speed of these missiles on a huge, flat, dry lake bed?



WE TEST THE WORLD'S FASTEST **SUPERBIKES**

Hill does a burnout at the drag strip prior to launching the Honda CB1100 through the quarter-mile. All four machines are capable of doing the quarter in about 11 seconds, hitting a speed of about 120 mph. Honda CB1100 posted the slowest speed at El Mirage Dry Lake—139.82 mph. But the CB1100 was the most comfortable bike of the four. Suzuki Katana went the fastest at 141.61 mph. It also handled the best at high speed. Kawasaki GPz1100 was second fastest at 140.53 mph. Like the Suzuki, the Kawasaki's seating position is uncomfortable for long-distance riding. Honda V65 was third fastest at 140.11 mph. Styled in boulevard cruiser fashion, its seating position is also uncomfortable for long-distance riding. Power, however, is not its shortcoming. It produces awesome torque. It also had a higher top speed in FIFTH gear than in SIXTH.

HONDA CB1100F

139.82 mph



**SUZUKI GS1100S
KATANA**

141.61 mph



KAWASAKI GPz ZX1100

140.53 mph



**HONDA V65 MAGNA
VF1100C**

140.11 mph



faster. The starting line was a couple of rocks. There was no flagman. I could take off whenever I wanted. The timing lights were waiting $1\frac{3}{10}$ miles away.

For my first pass, I was on Honda's CB1100F, a new bike for 1983. It is basically a punched-out version of last year's CB900, which, in turn, is a bigger version of the CB750. Its 1062-cc, DOHC, in-line, four-cylinder engine produces tremendous power throughout its power band.

The other new bike was Honda's V65 Magna. This state-of-the-art, water-cooled V4 has the most awesome torque, at any speed, of any street motorcycle I've ever ridden. On the instrument panel an LCD tells you what gear you're in—a nice touch. When you shift into SIXTH gear, "OD" shows up on the panel, indicating you are now in OVERDRIVE. Mechanically speaking, FIFTH gear is also an overdrive. The overall ratio for FIFTH is .897; for SIXTH it's .750.

From Kawasaki, we tried a GPz1100. Its space-age styling is backed up by a 1089-cc, DOHC engine with fuel injection. Acceleration is crisp and smooth. Handling on the back roads is good, but the racer-like seating position—although good for back-road charging—is uncomfortable for long-distance, straight-line riding.

Suzuki's offering was the GS1100 Katana. Like the Kawasaki, its seating position is good for the back roads, but not for casual or long-distance riding. However, the 1074-cc engine is another matter. It's very smooth at all speeds, and has tremendous low-end and midrange power.

All four bikes are incredibly powerful. In just four passes down the dry lake bed, I would soon learn which was the fastest.

I engaged first gear and accelerated away on the Honda CB1100. I was tucked in, body on the gas tank, legs and arms into the side of the bike to cut down wind resistance. As soon as I went through the lights, I got on the brakes lightly and shut off the throttle.

I repeated the same drill with the other three machines. The best handling bike on the lake bed at high speed was the Suzuki Katana. It felt like a train on railroad tracks, very confidence-inspiring. The worst handling was Honda's V65 Magna. It felt like a waterbed on wheels. Watch out next year, though. I think Honda will put the V4 engine in a sport chassis, and may have the most awesome street bike ever built.

But on this day at El Mirage, the results were these: The fastest motorcycle was the Suzuki Katana at 141.61 mph. Kawasaki's GPz1100 ripped through the traps at 140.53 mph. Honda's V65 hit 140.11 mph and the Honda CB1100 went 139.82. Less than 2 mph between the slowest and the fastest. The bottom line is simple. If you're in the market for a superbike, pick the one whose styling and ride most appeal to you. Any one is capable of far greater top speed than you'll ever need.

PM

PM OWNERS REPORT:

FORD TEMPO/ MERCURY TOPAZ

"A lot like Audi, but without the cost."

—CALIFORNIA GUIDANCE COUNSELOR

"Quality equals or beats Japanese models costing twice as much."

—LOUISIANA COMPUTER ANALYST

"This car rides like a large sedan."

—CALIFORNIA TEACHER



"The automatic is too jerky."

—IOWA INSURANCE SALESMAN

When Ford Motor Co. Design Vice-President Don Kopka urged his staff to "try something different," Ford really broke the me-too cookie mold. First, they completely redesigned the Thunderbird for 1984. And now, unlike their Fairmont and Zephyr predecessors, the new Ford Tempo/Mercury Topaz twins don't look like generic box-cars. They look, in fact, slightly European and very up-to-the-minute.

Thank goodness, we say, and so say the owners we surveyed. We sent out questionnaires to an equal number of Tempo and Topaz owners picked at random from state auto registration records. Our tabulations showed nearly identical opinions for both car makes. And styling led the parade of reasons why Tempo and Topaz owners chose their cars. Half told us that styling ranked first in their purchase decisions. Styling is also the feature they like best, now that they've had a chance to study and live with their cars.

There's no mistaking the Tempo and Topaz look. The cars are new all over—

from their more rounded lines to their suspender-like pillars. There are only minor styling differences between the two sedans. Practical design touches include tall roof-cut doors, hidden drip rails and a 0.36 drag coefficient in the two-door. Both the hidden rain gutters and the low Cd help hold down noise and drag at higher speeds.

Owners find big-car practicality can come in a compact package.

"The aerodynamic shape of my Topaz," said a Michigan materials controller, "undoubtedly contributes to the lack of wind roar. The car is also little affected by passing trucks and side winds." So there's more to these cars than pretty faces.

The Tempo and Topaz are 19.3 inches shorter than the Fairmont/Zeph-

yr, yet they still carry five people. That's where front-wheel drive gives a big plus—in helping lop length off the bigger cars.

The new Tempo and Topaz are still a little tight in the rear seat. "When a long-legged driver shoves his seat back," said an Illinois engineer, "whoever is in the back gets pretty uncomfortable." Even so, there's more rear legroom in the Tempo/Topaz than in Fairmonts and their many current derivatives, like the LTD. It should be noted, too, that all up-model Tempos and Topazes come with reclining front buckets.

Early Fairmonts suffered from another affliction, called "hypo-trunkitis"—a very shallow trunk (surgically corrected in later models). But Tempo and Topaz owners marvel at their vehicles' cargo capacity. This comes as another fwd benefit because, with independent rear suspension and the fuel tank tucked under the back seat, the trunk can be both wide and deep. Fact is, 14.3 percent of our owners listed trunk space as



"Dealer doesn't have parts in stock."

—NORTH CAROLINA SCHOOL PRINCIPAL

"Horn button on the stalk is not another 'Better Idea'."

—FLORIDA HOUSEWIFE



Elimination of rear-drive hardware means that the Tempo and Topaz can have a big, deep trunk (top). The transversely mounted, 2.3-liter, pushrod engine (left) impressed many owners with its pep. Doors curve into roof (right)—just like a T-Bird or Mercedes—but internal rubber rain gutter (arrow) gave some owners problems.

one of the aspects they like most about their Tempos and Topazes.

A New York retired couple told us, "We play golf, and none of the other compact cars we looked at had trunks big enough for our three golf bags and carts. This Topaz does, though, and has room for one more bag!"

Ford makes a big thing about quality being "job one." There's no doubt that Ford and other Detroit manufacturers are closing the quality gap, but do Tempo/Topaz owners agree that their cars indeed came through with "job one" quality?

Apparently so, because about 95 percent gave workmanship a mark of good to excellent. That's right up there with the '84 Thunderbird which, in our Sept. '83 Owners Report (page 79), was right up there with the best of the imports.

As a California woman who listed her occupation simply as "redhead" put it, "Finally Detroit has put a car on the road that doesn't sound or look tinnny, that doesn't rattle, that feels like it will stay together past the warranty." A

Louisiana computer analyst added, "Our Tempo's quality equals or bests Japanese models costing twice as much."

Not that everything's all rosy in Tempo/Topazland. For example, the hidden rain gutters, which consist of rubber grooves just outside the weatherstripping, sometimes don't spring back into

sucked into the interior. If the trapped dust gets wet, it turns into mud."

We heard reports, too, of the automatic transmission shifting roughly—a harsh SECOND-THIRD shift—in about 20 percent of our total survey. That puts the figure at nearly 30 percent of our automatic-transmission-equipped cars. An Iowa insurance salesman explained it this way: "The automatic is too jerky. It works fine under hard acceleration, but when I'm just driving along normally, it jerks when it shifts between SECOND and HIGH. Also, when running near the shift-point speed, it will often shift up and down several times in a few seconds. It's annoying to have to speed up or slow down to avoid this jerky range."

This is a problem we've heard before: When the Escort and Lynx came out in 1981, their early automatics had the same hard-shifting and hunt/peck characteristics. Escort and Tempo transaxles are similar in design, although they're not identical. However,

(Please turn to page 118)

A NATIONWIDE SURVEY BASED ON 857,230 OWNER-DRIVEN MILES

their channel shape. They get pressed shut by the doors and can't drain water away from the passenger compartment.

Along similar lines, an Illinois farmer told us, "On our dirt roads, the ledges between the roof and the rubber seals tend to collect dust. Then, when I open the door to my Tempo, this dust is

BUILD A North Woods Retreat

Handsome, sturdy and affordable,
the log cabin is still a great choice if you
want to build your own home.

BY MICHAEL CHOTINER; Illustrations by Harry Schaare

Mankind's preference for living in structures made of natural timbers is longstanding and well documented. One story from the rich folklore of log building tells how a Grand Master of the Teutonic Knights insisted, around the year 1500, that a wood structure be built onto his stone castle to provide a homier place to live. Many log structures built in the same period still stand in Scandinavia, Central Europe and the Balkans.

Each area developed its own distinct methods, from the square-hewn log homes of France to the dovetail-joined cabins of Germany. But when all these influences were transplanted to the New World, the Scandinavian style of round logs with bottom-cut corner notches prevailed. Examples of this method can be seen across the United States.

Log building has always required a lot of patient, physically demanding work. And for the modern builder, it also requires learning some new skills.

Here's a short course in log building to show you what's involved.

Opinions about log selection and proper cutting season vary with the individual craftsman and the building locale. In general, just about any type of log can be used, as long as it's relatively straight, is around 8 to 10 in. in diameter and has only minor tapering—no more than 2 in., in a 16-ft.-long log. Conifers such as pine, fir, spruce and tamarack are preferred because these softwoods are workable, durable and relatively lightweight. Hardwoods, particularly oak, can also be used, though their sapwood is highly susceptible to infestation by borers and fungus.

Trees should be felled in early winter. The cooler temperatures make for slower drying time, which reduces log checking, cracking and splitting. It's also easier to haul logs out of the forest over frozen terrain.

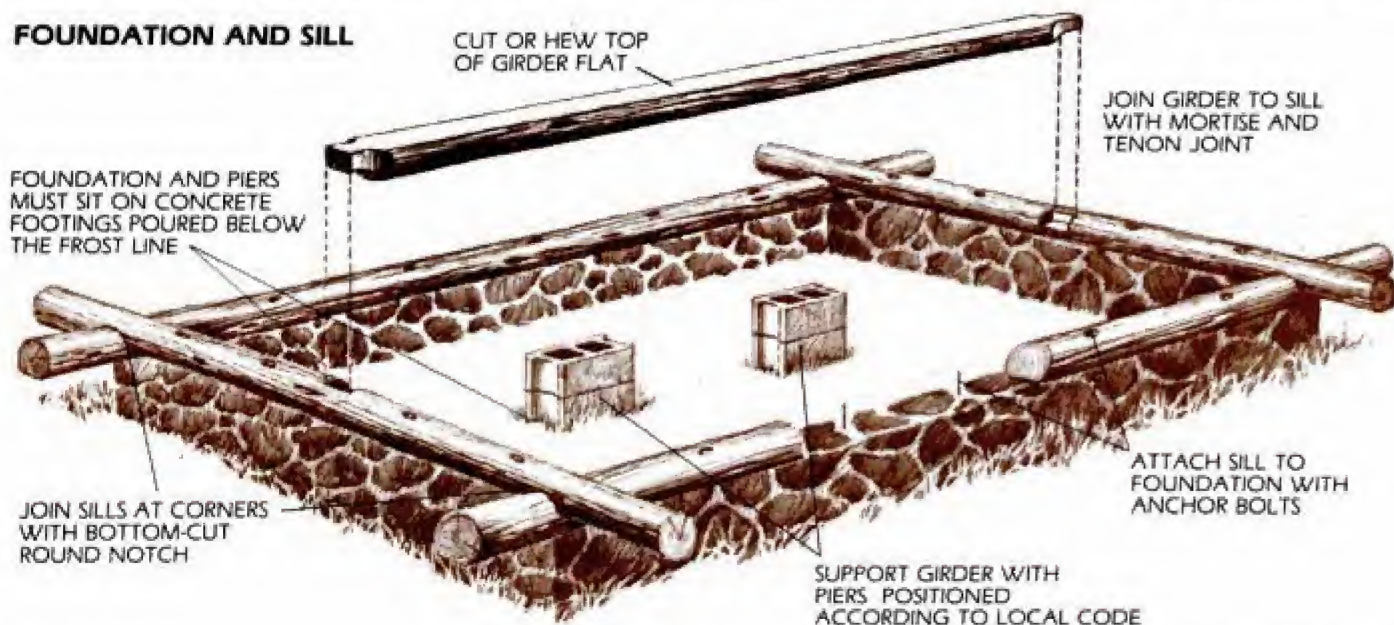
The best seasoning method is to air-dry the logs for one to two years—the longer the better. Logs should be

stacked off the ground with stickers—smaller diameter logs—placed between the courses. This allows for maximum airflow around the logs and promotes more even drying. You should also partially peel off the bark using a draw knife before the logs are stacked. This will increase their drying rate and cause only minimal cracking and splitting. However, before building begins, you must remove the remaining bark completely. It is a natural habitat for many different kinds of pests.

Many pioneer cabins were built without foundations because they were constructed in haste or meant to be temporary shelter. But a proper foundation is definitely required. Stone foundations are traditional, but block and concrete walls are as good, or better, and they require less work.

If you don't want a full basement, you must excavate at least below the frost line, install footings and construct a wall up to 20 in. above grade level. You must also install piers within the

FOUNDATION AND SILL





foundation walls to support the floor girder. Also, install anchor bolts along the top of the walls to attach the sill.

Begin floor construction by hewing or cutting flat the bottom of the sill logs. Then bore holes in the sill logs to accommodate the anchor bolts and install sill sealer or a termite shield

according to the local building code. The corner joints are made by bottom notching the logs as shown on page 98.

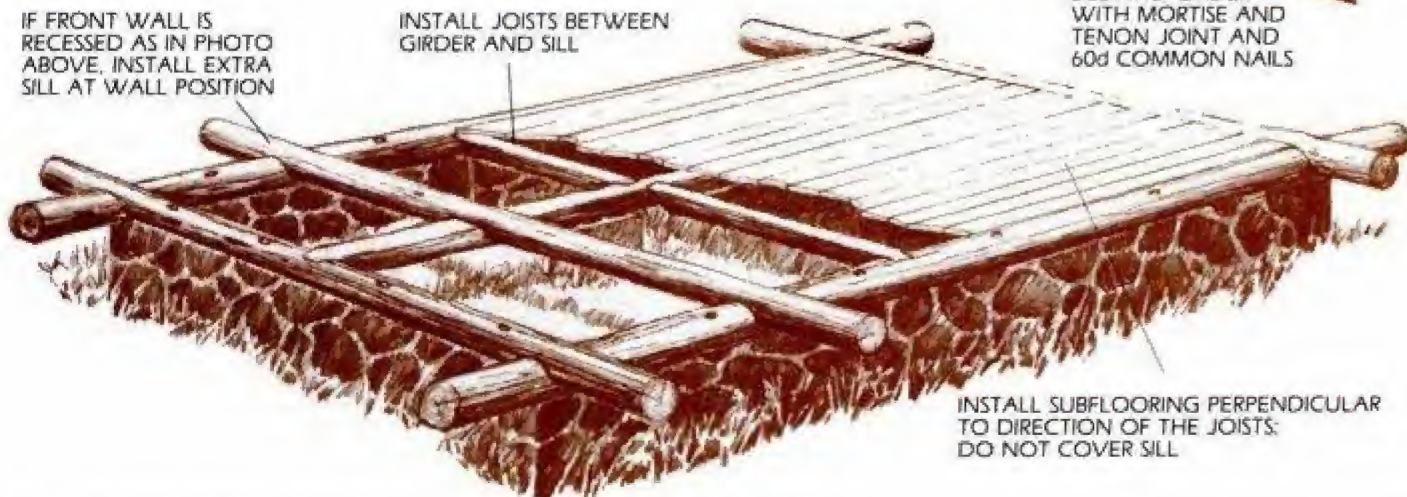
Next, hew flat the top of the girder and install it over the support piers. Join it to the sill with a mortise and tenon joint. Drive 60d nails through the

Log-building techniques vary greatly, depending upon the region of the country and the individual builder. This cabin uses the "scribe-fit, round-notch" method.

JOISTS AND SUBFLOORING

IF FRONT WALL IS RECESSED AS IN PHOTO ABOVE, INSTALL EXTRA SILL AT WALL POSITION

INSTALL JOISTS BETWEEN GIRDER AND SILL



INSTALL SUBFLOORING PERPENDICULAR TO DIRECTION OF THE JOISTS; DO NOT COVER SILL

top of the tenon and into the mortise to complete the joint.

In a similar manner, hew or cut flat the top of the joists and install them between the girder and sill logs so they are flush with the top of the girder. Install the subflooring perpendicular to the direction of the joists. Now you're ready to start on the walls.

Many different types of notches can be used to join the logs, but a good choice for the beginning log builder is the technique shown here: the scribe-fit, round-notch method. It features semicircular notches cut in the bottom of the logs to fit over adjacent logs. Also, a V-shaped groove is cut down the length of each log bottom so the entire length can sit flush on the log below.

Although this method is slower than others, the corner joints are self-drain-

ing—water running down the outside of the house hits the log tops and runs off, instead of being trapped in the notch. The V-grooves also eliminate air drafts between the logs. The joints between courses do not need chinking, so you can avoid one of the most chronic maintenance problems of log homes: repairing cracked chinking.

Cutting the corner notches is a five-step procedure.

1. First, roll the log into position and sight along its length to make sure any crown is pointing to the outside of the wall. Try not to use logs that have more than a 1-in. crown per 16 ft. of length. Then secure the log with a log dog as shown in the drawing.

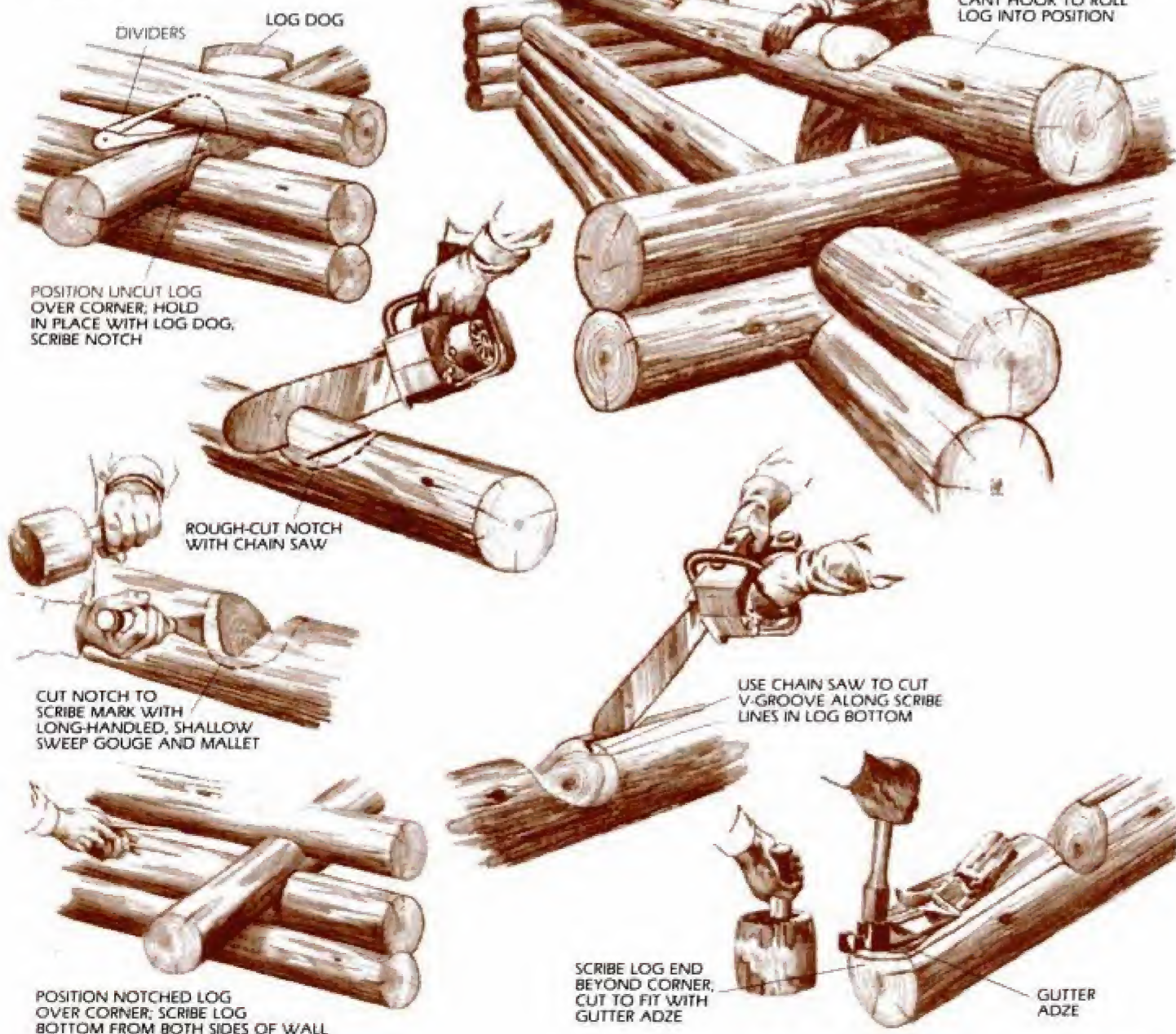
2. Scribe the shape of the lower log onto the uncut log using compass dividers with a pencil or marking crayon inserted in

one leg. Rough-cut the notch with a chain saw, then finish it with a shallow-sweep, long-handled gouge.

3. Reposition the log, allowing the notch to seat. Then scribe the full length of the underside of the log running the blank leg of the dividers along the top of the lower log. Scribe both sides of the log to yield the two lines which define the V-groove.

4. Cut the V-groove with a chain saw to a depth of $\frac{1}{2}$ to $\frac{3}{4}$ in. Remove the waste, then roll the log back into position and rescribe the corner notch as well as the log end extending past the notch. (By cutting the V-groove, there is now some space between the scribed log and the one below.) Cut the notch to the new scribe line and cut the tail end of the log using

LOG JOINERY



LOG-BUILDING SCHOOL

In log building, as in any skilled work, the best way to learn is by doing. That's why, after much research, we went to the Minnesota Trailbound School of Log Building, near Ely, Minn., to take part in one of their hands-on courses in practical log building.

The courses are taught by the school's director, Ron Brodigan, who is not only a tree farmer and wilderness guide, but a log-building historian, lecturer and author. Brodigan leads a group of about 20 people through every phase of log building, including felling the trees; preparing the site; building a foundation; scribing, cutting and fitting various log joints; and framing the roof structure with natural timbers. Each session lasts 10 days. The goal is to complete a small cabin within that time.

After the 10- to 12-hour workday is

done, Brodigan supplements the practical training with lectures and slide shows on the history of traditional log-building methods, as well as the important characteristics of different tree species.

This course is not for the fainthearted. However, no prior experience is required, nor is greater-than-average strength. People 18 or older are accepted and the enrollment fee includes lodging at one of the base camp cabins.

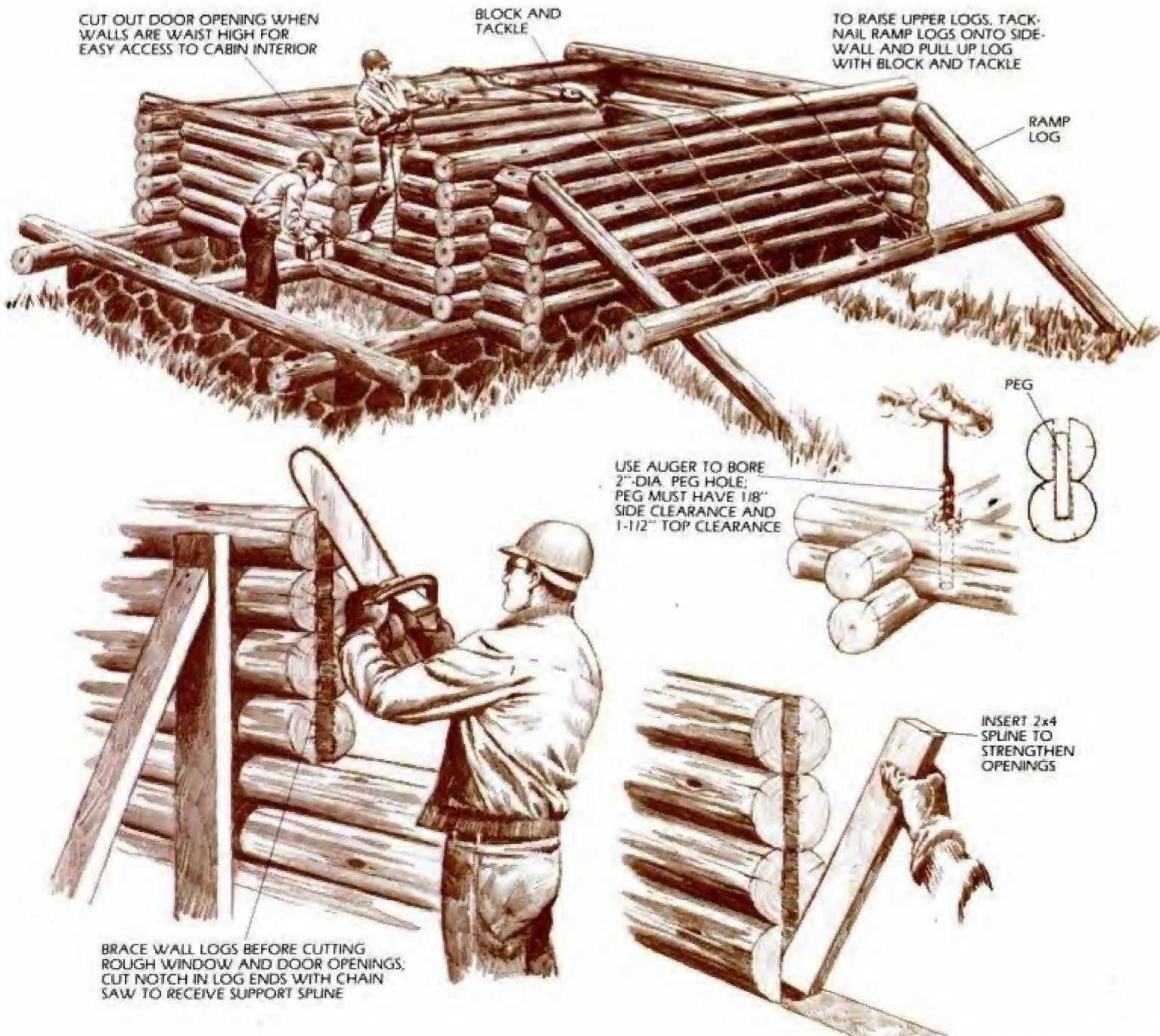
To get the most out of the course, it's best to bring your own tools so you can practice with them at will instead of waiting for others to be passed around. For more information, write to Minnesota Trailbound School of Log Building, 570 County Road 2, Isabella, Minn. 55607. The school also offers instruction in stone-cabin building and fireplace construction.—M.C.

a gutter adze. This tool yields a concave groove that is tighter and more attractive at the exposed log ends.

5. Reposition the log, then pick up one end and drop it into place. This is called "thumping" and it will leave compression marks on the parts of the log that still need trimming. Make any necessary adjustments, then pack fiberglass insulation into the groove and roll the log into place. The fiberglass will act as a sort of "internal chinking."

With the notching complete, bore a 2-in.-dia. hole about 8 in. in from each corner and insert an alignment peg. The peg should be loose fitting, recessed about 1½ in. below the top of the hole, and extend about halfway into the log below. Install these pegs every 8 ft. in the length of a log and within 1 ft. of each window and door opening.

As you move up the walls, alternate



each successive log so that their smaller, tapered ends are not all on one end of the wall. Once the logs reach waist height, cut out the door opening. Brace the logs on both sides.

Of course, if your cabin is larger than the one shown here, you'll have several interior partitions. These can either be made with logs notched into the outside walls or with framed walls later on. Notching the logs is preferred because it yields the same interior finish on all walls and strengthens the structure.

When the logs reach the top of your planned window and door openings, brace the walls and cut out all the openings at once. Then cut a groove, as shown, in the log ends on both sides for a permanent stiffening spline. Cut and insert the spline and then add at least two more logs

over the openings. The top wall log is called the plate log and it should be pegged at least every 4 ft.

The roof on the cabin shown is a combination of purlin and rafter construction to give an idea of what's involved with both. Normally, you would use only one. The purlins are set into notches cut in the gable ends; the rafters are notched into the plate log and ridge log.

Once purlins or rafters are installed, apply roofing boards for the roof sheathing. Next, apply 15-lb. roofing felt and either asphalt shingles or cedar shingles.

Finally, preassemble all window and door jambs, install them in the openings, and add the windows and doors.

Allow $\frac{3}{8}$ -in. clearance for each vertical foot of

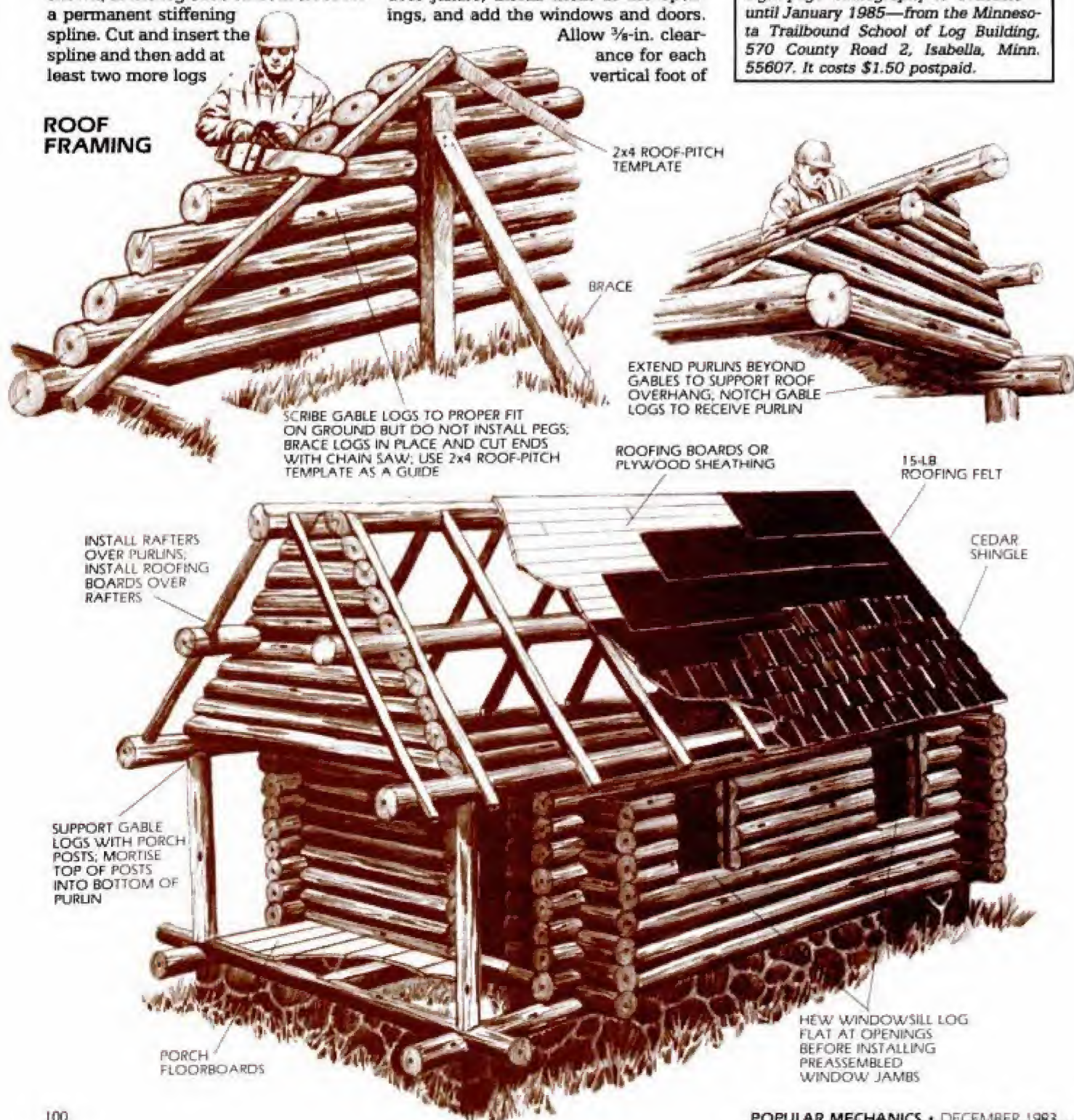
opening above the jambs for the logs to settle. The spaces around the jambs should be chinked with okum (hemp and pine tar).

Wash the logs with detergent to remove any dirt, and then with a solution of two parts household bleach to one part water to lift out any stains. Rinse the logs thoroughly with water and let them dry for a week. Then apply a mixture of one part linseed oil to five parts turpentine to the outside of the logs. This treatment should be repeated every five years.

PM

If you're interested in reading more about log building, a comprehensive, eight-page bibliography is available—until January 1985—from the Minnesota Trailbound School of Log Building, 570 County Road 2, Isabella, Minn. 55607. It costs \$1.50 postpaid.

ROOF FRAMING



HOW TO BEAM A CEILING

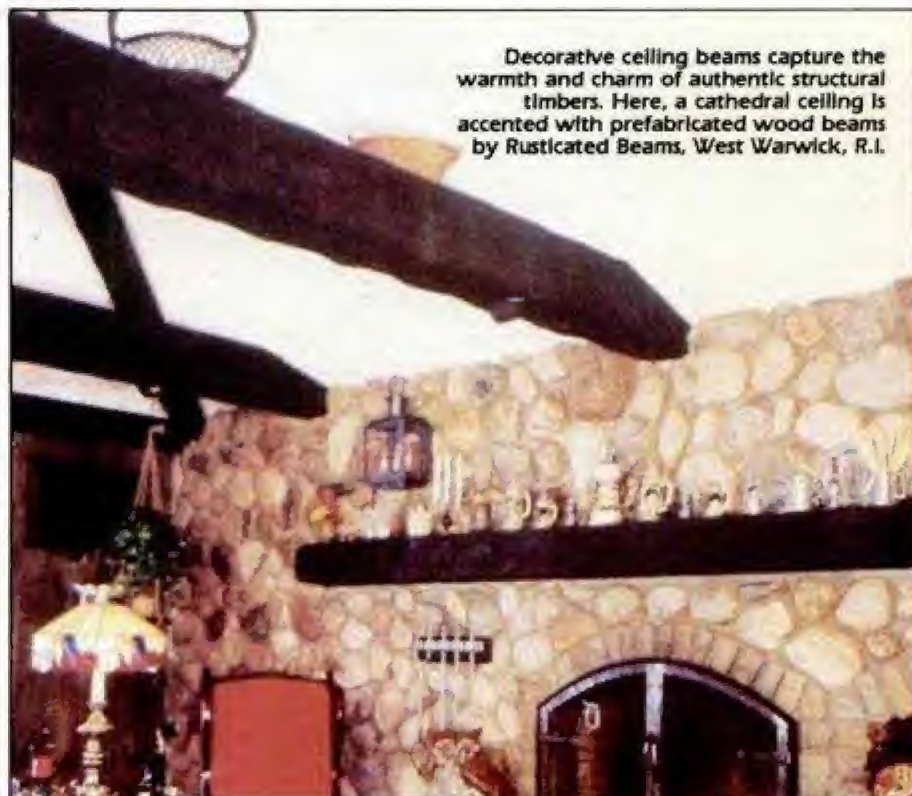
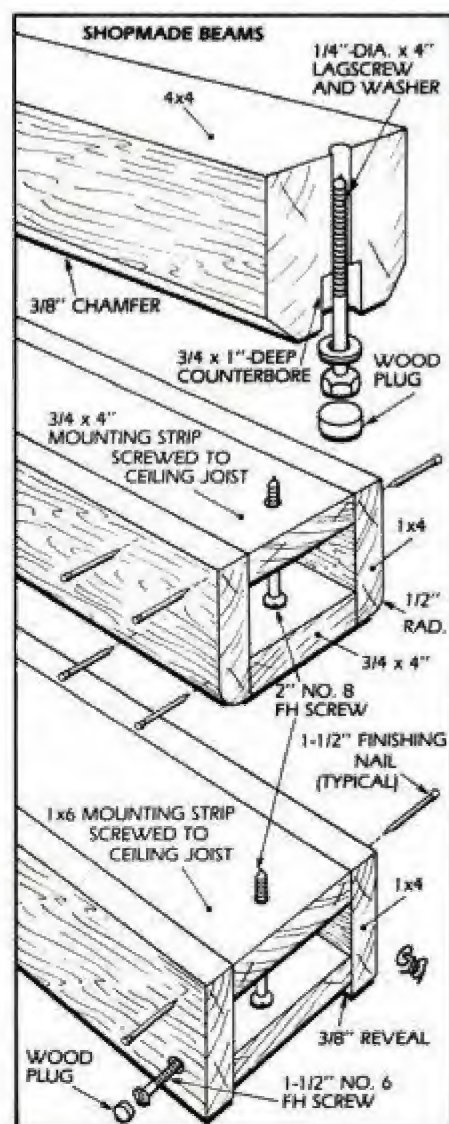
Here's how to buy, build and install decorative beams to create a custom country ceiling.

BY JOSEPH TRUINI
Asst. Home And Shop Editor

In spite of the countless hours spent making painstaking decisions on redecorating a room, the largest visible surface, the ceiling, is often overlooked. But, install decorative beams and that ceiling is suddenly an attractive detail that enhances the room.

Prefabricated ceiling beams come in polyurethane foam and real wood. Both are designed for do-it-yourself installation. In addition, you can make your own by following our plans for building and installing beams.

Lightweight polyurethane foam beams have been popular with homeowners since about 1967. Although many purists shy away from synthetic products, polyurethane beams provide a means for anyone, regardless of his



Decorative ceiling beams capture the warmth and charm of authentic structural timbers. Here, a cathedral ceiling is accented with prefabricated wood beams by Rusticated Beams, West Warwick, R.I.

woodworking skills, to install a ceiling he'll be proud to show off.

Cut foam beams using a crosscut handsaw. Then, attach the beams to the ceiling with panel adhesive dispensed from a caulking gun. First, hold the beam against the ceiling and draw a light pencil line along each edge of the beam. Next, apply an adhesive bead on the inner edge of both underside rails, where the beam makes contact with the ceiling. Now, here's the secret for a lasting bond: Press the beam firmly against the ceiling. Then, pull it away for at least one minute, but not more than five. Finally, reposition the beam, using the pencil lines as guides, and apply pressure for two minutes.

For those who prefer real wood, Rusticated Beams Inc. of West Warwick, R. I., manufactures prefabricated pine beams. The three-sided beams come in sizes from 4 x 6 in. to 18 x 18 in.

To install the beams, first screw a 3/4-in.-thick mounting strip to the ceiling. Cut the strip width equal to the inside opening of the beam. Be certain that the screws are long enough to go into the ceiling joist to hold the beam securely. Now, hold the beam over the mounting strip and nail through the beam side into the strip.

As an alternative to buying ready-made beams, use our plans to build them. The two basic beam designs are

the solid and three-sided box beams.

To install a solid beam such as 4x4, 4x6 or larger timber, lagscrew it directly to the ceiling with screws long enough to catch the ceiling joist.

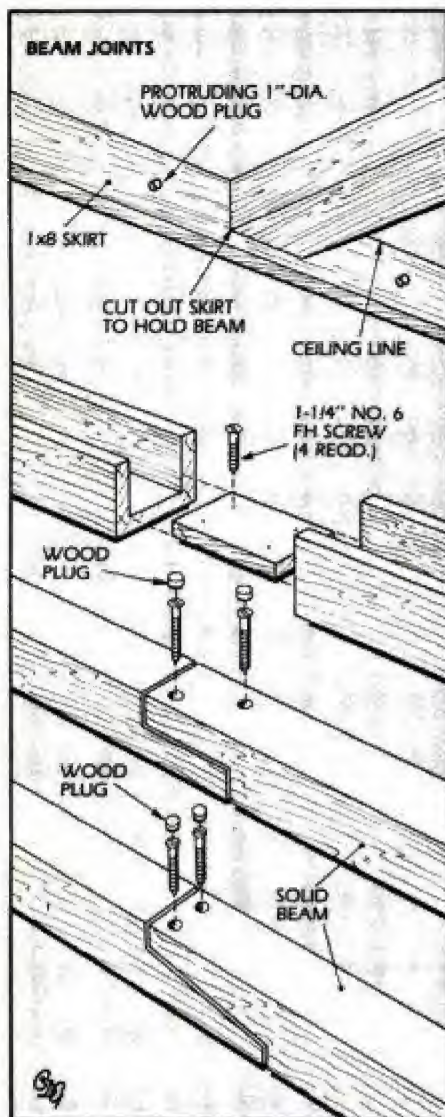
Install a box beam over a mounting strip fastened to the ceiling. Again, be sure to screw into the joists. Then, nail through the beam side into the strip.

At times, the desired beam location may fall between the joists, leaving nothing solid to screw into. In this situation, you must get above the ceiling, via an attic or crawlspace, to nail 2x4 bridging between the joists. Then, mount the beam to the bridging.

When installing any type of ceiling beam, always start and end with half-beams against opposite walls. For example, if 4x6 beams are used, space them between the 2x6 beams at each end of the room. This is in keeping with authentic beam construction.

Finishes that resemble hand-hewn and rough-sawn timbers are the most popular for shopmade beams. Use a broad ax, hatchet and spokeshave to produce a hand-hewn texture. Chop and scallop the beam to create the desired effect. Distressing is then added, if desired, to produce a weathered look by striking the beam with a heavy chain, hatchet and hammer.

To create a rough-sawn texture, first use a chain saw to roughen the beam's



Wood Beams Add Warmth To A Suspended Ceiling



surface. Work the saw back and forth along the beam, scoring but not cutting into the surface. Then, use a wire wheel in a drill motor to brush out the wood's soft grain. *Caution:* Wear eye protection during the above operations.

Another way to achieve a rough-sawn look is with a band saw fitted with a rough-cutting wood blade or a 3-t.p.i. resawing blade. To roughen the surface, start the saw and move the beam slowly across the saw blade, perpendicular to the teeth. Allow the blade to roughen the beam, but not cut into it.

Next, use a rasp, drawknife, spokeshave and/or belt sander to take the sharp edges off the beam's two bottom corners. The more hand tools used, the more authentic the look.

Finally, the beam is ready for staining. A hand-rubbed oil finish (be sure to wear gloves to avoid splinters) is an attractive alternative to stain. **PM**

MANUFACTURERS LIST—BEAMS

Polyurethane beams

Paeco Inc., Box 968, Toms River, N. J. 08753.
Nyrex Inc., 390 Nye Ave., Irvington, N. J. 07111.

Wood beams

Rusticated Beams Inc., 1542 Main St., West Warwick, R.I. 02893.

Barnwood of Yesterday, Box 321, 30 Plane St., Boonton, N. J. 07005. Authentic weathered barnwood and hand-hewn beams.

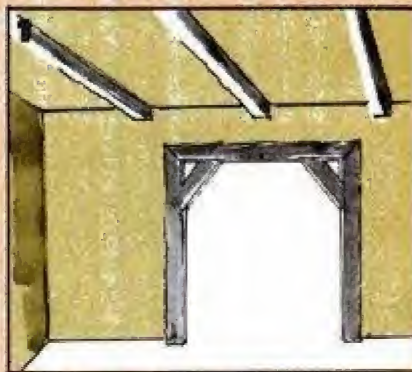
A Professional Decorator's

We contacted a professional New York decorator for her advice about using decorative beams correctly. By following her guidelines below, you, too, can decorate with flair.

New varieties of prefabricated wood and polyurethane beams easily enable the do-it-yourselfer to provide architectural interest to many areas. With a few exceptions, beamed ceilings are adaptable to most every style home. Where it wouldn't be advisable is in a Victorian home with ornate moldings, or in a contemporary, high-tech structure.

1 Beams can lend individuality to a tract house or can be

used to balance a ceiling where a structural change has replaced a



bearing wall with a structural beam. For style continuity, frame the door opening into the room with the new beams.

Installed a beam ceiling and a suspended ceiling recently—at the same time. Surprisingly, the attractive beam ceiling shown here is a suspended ceiling. The ceiling system is the creation of Gary Kern of Kern Wood Beam Ceilings. It incorporates oak beams instead of the usual metal T-bars. The 4-in.-wide beams consist of two hardwood oak rails joined by a 1/4-in. oak veneer plywood panel. The beams are locked together and hung from the existing ceiling using an ingenious assortment of metal clips developed by Kern. The ceiling accepts standard ceiling panels and lighting fixtures. We installed 2×4-ft. Armstrong plain white panels (No. 280) and two Armstrong Gridmate fluorescent lighting fixtures (No. 954). Kern ceilings are also available to fit 2×2-ft. panels.

You can install the Kern ceiling as easily as a conventional T-bar suspended ceiling. Begin by determining the new ceiling height. Be certain to allow clearance for all obstructions. Next, mark the height in one corner of the room. Using a dry line with a line level, transfer the height to the next corner. Continue transferring until each corner

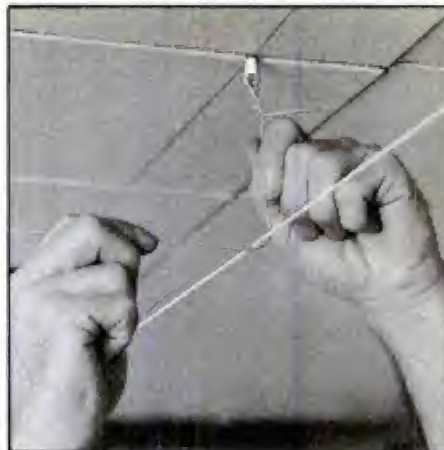
(Please turn to page 114)

PM color and black-and-white how-to photos: Carl Weese

Room design: Gabe Herrick
Ceiling: Kern Wood Beam Ceiling, 515 North Victory Blvd., Burbank, Calif. 91502.
Ceiling panels and lights: Armstrong World Industries Inc., Box 3001, Lancaster, Pa. 17604



Snap a level chalkline to indicate ceiling height. Then, nail oak side rail in place. Pre-bore rail to prevent chance of splitting.



Bend hanger wire 90° at dry line that's stretched to show main beam location. Acoustical lag anchors wire to ceiling.



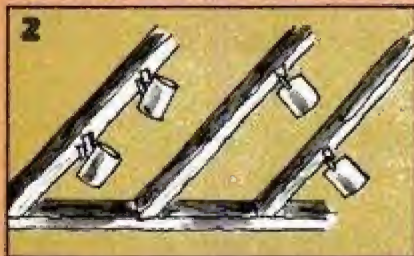
Attach the main beam to the side rail using a rail clip (inset). Then, screw through the clip and into the rail to secure the beam.



Check main beams for level after installation. Note that hanger wire passes through a hanger clip. Prevent wires aid positioning.

Guide To Beam Installation

2 Install track lighting on beams in a room that has a cathedral ceiling. The area be-



tween the beams can be finished with plaster, paint or planks.

3 Create an Early American country kitchen by adding beams that can hold baskets, pots and pans, or lighting fixtures. Lighting on beams can

illuminate counters and bars at right angles to the wall.



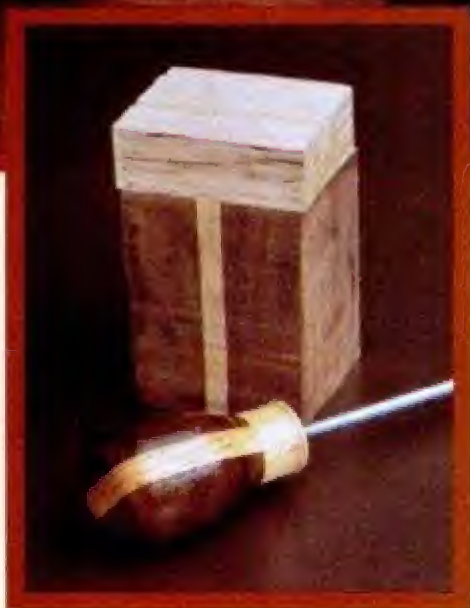
4 To reproduce an English Tudor look, hang beams in two directions to form squares or rectangles. Trowel on plaster to the area between the beams.



Use dark beams, French antiques or reproductions and a mix of small provincial prints to transfer an ordinary room into one of charm.—Gabe Herrick



Tools with custom handles include: a screwdriver, an awl, carving knives, chisels and coin probes used with metal detectors.



This elegant tool handle was turned from a laminated block of walnut and oak. Handle was then bored to accept the tool's tang.

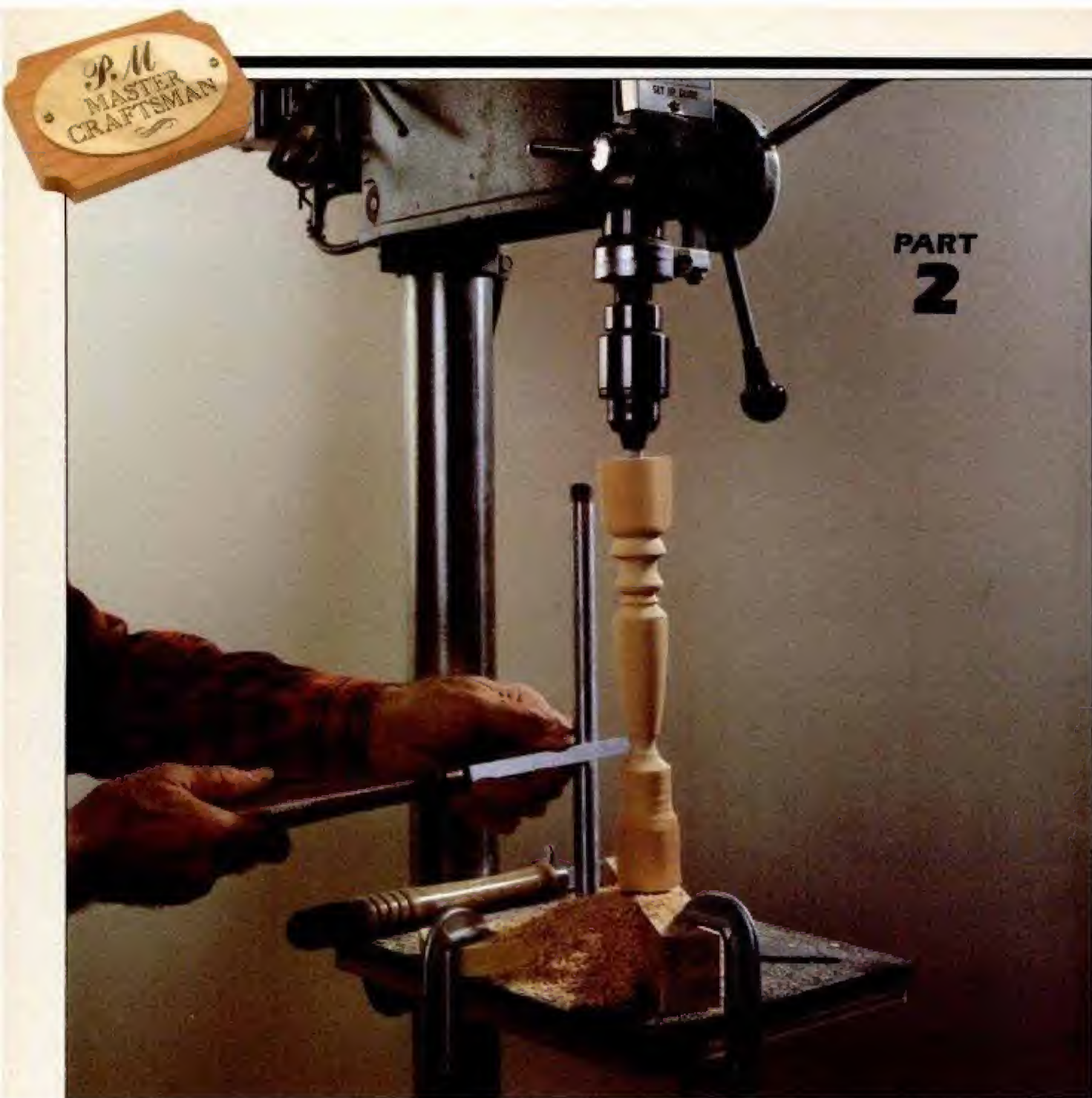
The Artful Handling Of Tools

Create handles fit for a craftsman's tools by gluing blocks of scrap wood and turning them on a lathe.

BY DUNCAN DOUGLAS

COLOR PHOTOGRAPHS BY BILL ASHE

Illustration: JENNIFER HARRIS



2 Great Woodworking Jigs For Your Shop

These easy-to-make jigs follow last month's array.

TEXT AND PHOTOS BY ROSARIO CAPOTOSTO

Here in Part 2 PM's Master Craftsman reveals nine more of his favorite shop jigs. These easy-to-build jigs have been designed and shop-tested by PM to help you create more professional-looking woodworking projects. Detailed plans and instructions are included for building each jig. Several of the

jigs shown here, and in Part 1 last month, are designed to permit a specific tool to perform jobs other than its designed purpose, such as turning wood on a drill press or performing sanding operations on a lathe. All of the PM shop jigs allow you to build projects with greater safety, accuracy and speed.

1 Drill press turning jig

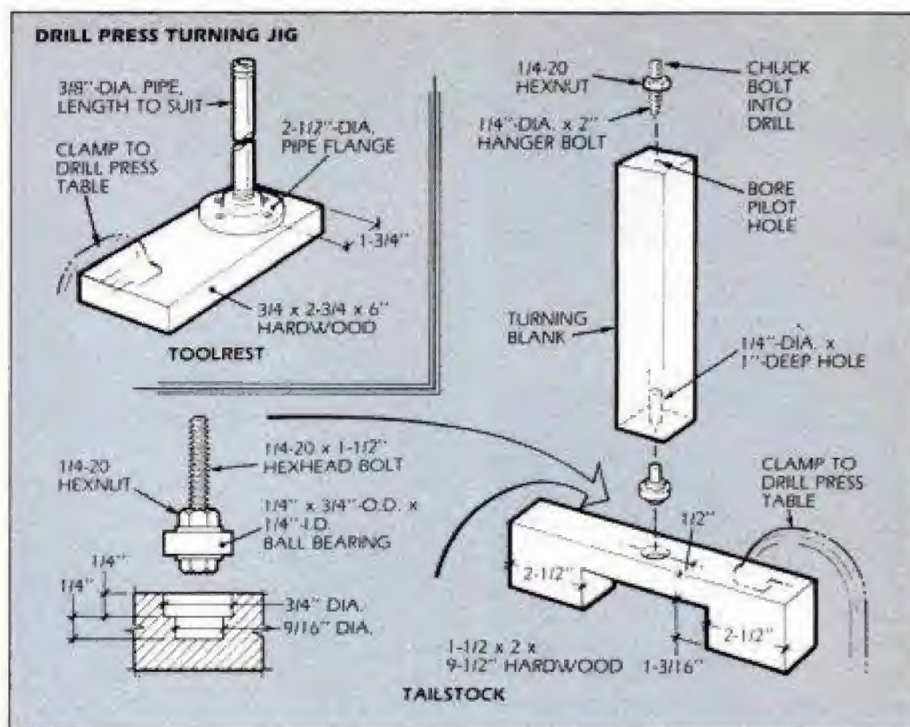
The lathe is generally considered the only tool capable of turning stock. But with this simple jig, you can produce small turnings on a drill press. The jig consists of an improvised tailstock and toolrest. The drill press chuck performs the lathe headstock duties.

First, cut the hardwood tailstock according to the drawing. Then, bore a 1/4-in.-deep \times 3/4-in.-dia. hole into the tailstock, using a spur point bit to obtain a flat-bottom hole. Now, bore an additional 1/4 in. deep, using a 5/16-in.-dia. bit.

Make up the tailstock ball-bearing assembly as shown. Then, tap the bearing assembly gently into the tailstock hole. The bearing should fit snugly enough so that only the projecting bolt spins freely.

Build the toolrest, using 3/8-in.-dia. pipe and a 2 1/2-in.-dia. pipe flange. Cut the pipe about 12 in. long to accommodate most drill presses.

Next, bore a 1/4-in.-dia. \times 1-in.-deep hole centered in the bottom of the turning blank. Then, bore a 1/8-in.-dia. pilot hole centered in the top of the blank. Now, thread a nut onto a 1/4-in.-dia. \times



2-in. hanger bolt. Using a wrench, turn the bolt's woodscrew threads into the pilot hole until the nut is tight against the wood. Next, chuck the hanger bolt into the drill and insert the tailstock bolt into the blank bottom hole. Once in

position, clamp the tailstock and the toolrest to the drill press table.

The jig shown is suitable for turning blanks up to 1 1/2 in. dia. \times 12 in. For larger work, use a 1/2-in.-dia. pipe for the toolrest.

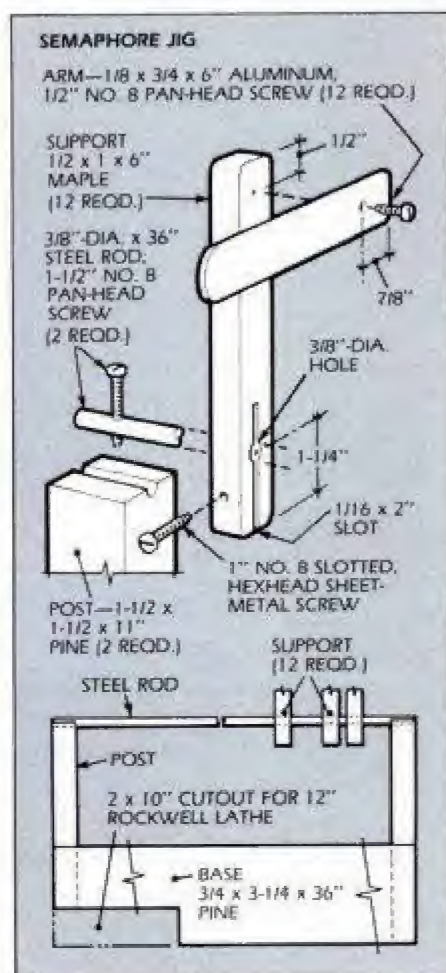
2 Lathe semaphore jig

The semaphore jig will help you duplicate diameter sizing cuts when making exact, repetitive turnings on a lathe.

Begin by turning the first blank in the standard manner, using calipers. Adjust the jig to allow each semaphore arm to just drop through the sizing cuts in the first turning. Next, place a new blank on the lathe with the preset arms resting on top of the blank. Draw pencil lines alongside each arm to indicate the location of the sizing cuts. Using a parting chisel, cut on the pencil lines just deep enough to let the arms pass through. The result is a series of diameter sizing cuts identical to the original blank.



Use a parting chisel to cut on the pencil lines which indicate the preset arms' positions. Cut just deep enough to allow arms to fall through. Note the first three arms.



3 Crown molding mitering jigs

Crown, bed and cove moldings are all installed in an angled position. Therefore, a 45° mitered corner joint requires a compound angle cut—a chore many woodworkers find difficult to master, resulting in expensive waste.

The two jigs shown here, one for the radial-arm saw and one for the table saw, provide an easy way to cut numerous compound angles accurately.

In both jigs, the molding is held and cut in the same angled position as it's installed. Therefore, the saw blade remains set at 0°. This eliminates the trouble of tilting the blade to possibly inaccurate settings.

To cut compound miters on the radial-arm saw, simply position the jig to the left or right of the saw blade, depending on the desired angle. The table saw jig is used in conjunction with the table saw miter gauge.

Screw the jig to the miter gauge and swing it to the left or right for the desired angle. Note that the jig must have two sets of mounting holes to work properly (see drawing).

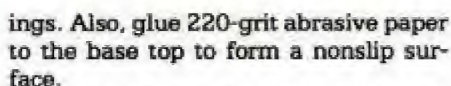
Build both jigs from 3/4-in. plywood. Because the work support walls are independent of the base, the jig can adjust to accept different width mold-



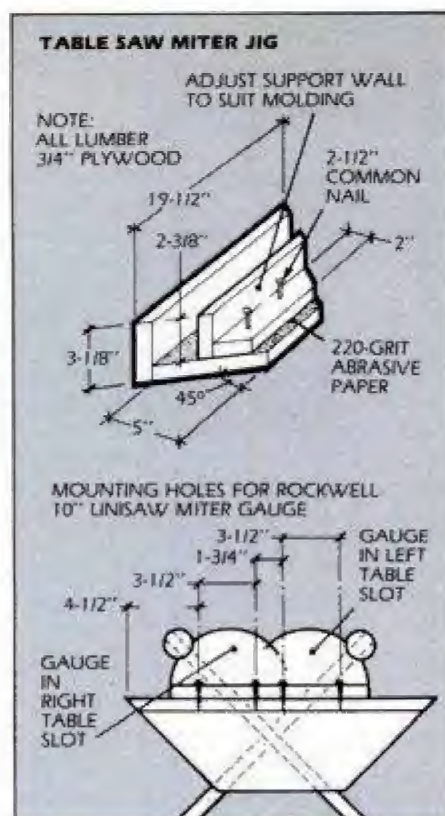
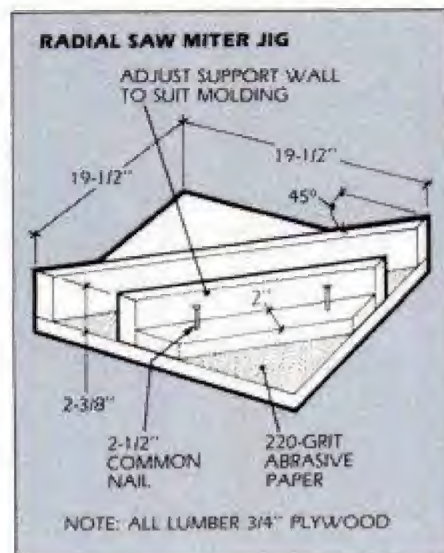
Cut tricky compound-angle miters in crown, bed and cove moldings with a radial-arm saw. The jig holds the molding at same angle as it's installed for accurate cuts.



Screw the table saw jig to the miter gauge for cutting accurate compound angles on the table saw. Tack-nail the support wall to the base to hold molding securely.



The big advantage of these jigs is that they permit you to cut moldings to exact lengths. Simply align the cutting mark with the jig edge for accurate first-time cuts.

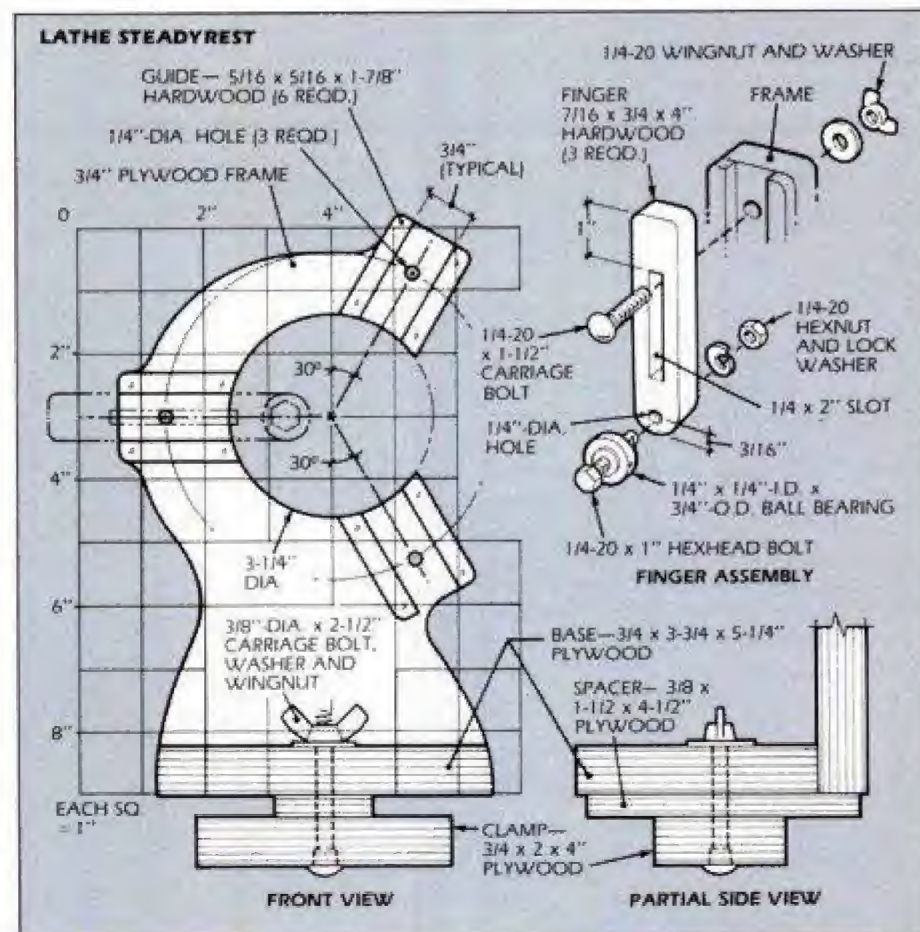


4 Lathe steady rest

A lathe steady rest prevents spring and vibration when working long, thin stock on a lathe. It's especially helpful for turning precise decorative spindles. The plywood frame is fitted with three hardwood fingers which are tipped with a ball bearing. Place the turning blank through the frame opening and



Install the lathe steady rest securely to the lathe bed to prevent long, thin stock from wobbling during turning operations. Ball-bearing-tipped fingers support blank.



adjust the fingers to closely surround, but not touch, the blank. Then, as the blank spins, the fingers will keep it from wobbling excessively. The jig shown is dimensioned for use on a 12-in. Rockwell lathe. Alter the size to fit

other makes. Build the frame using 3/4-in. plywood. Use hardwood for the fingers and guide strips.

First, assemble and install the fingers to the frame. Next, slide the three fingers toward the exact center of the

frame opening until the bearings meet. Then, nail and glue the guide strips in place.

Mount the jig to the lathe bed, using the carriage bolt and wingnut clamp assembly.

5 Table saw mitering gauge

The table saw mitering jig is an old shop favorite for executing precise 45° miter cuts.

Our improved version shown here features a clamping device which prevents the workpiece from creeping while being cut. The clamping device consists of a sliding bar and a flexible wedge which hold the workpiece tightly against the backstop.

Cut the platform from 3/4-in. plywood. Use hardwood for all of the other parts.

First, cut shallow recesses into the platform for the sliding bar, using a router and a straight cutter. Then, assemble the sliding bar and the flexible wedge as shown. Note that the wedge front strip is thinner than the back strip. This allows for the necessary flex to hold the workpiece securely.

Now, attach two hardwood strips to the platform underside to ride in the saw table miter grooves.

Next, use a plastic triangle to position each backstop. Take the time to check for a precise 45° cut before gluing and final assembly.

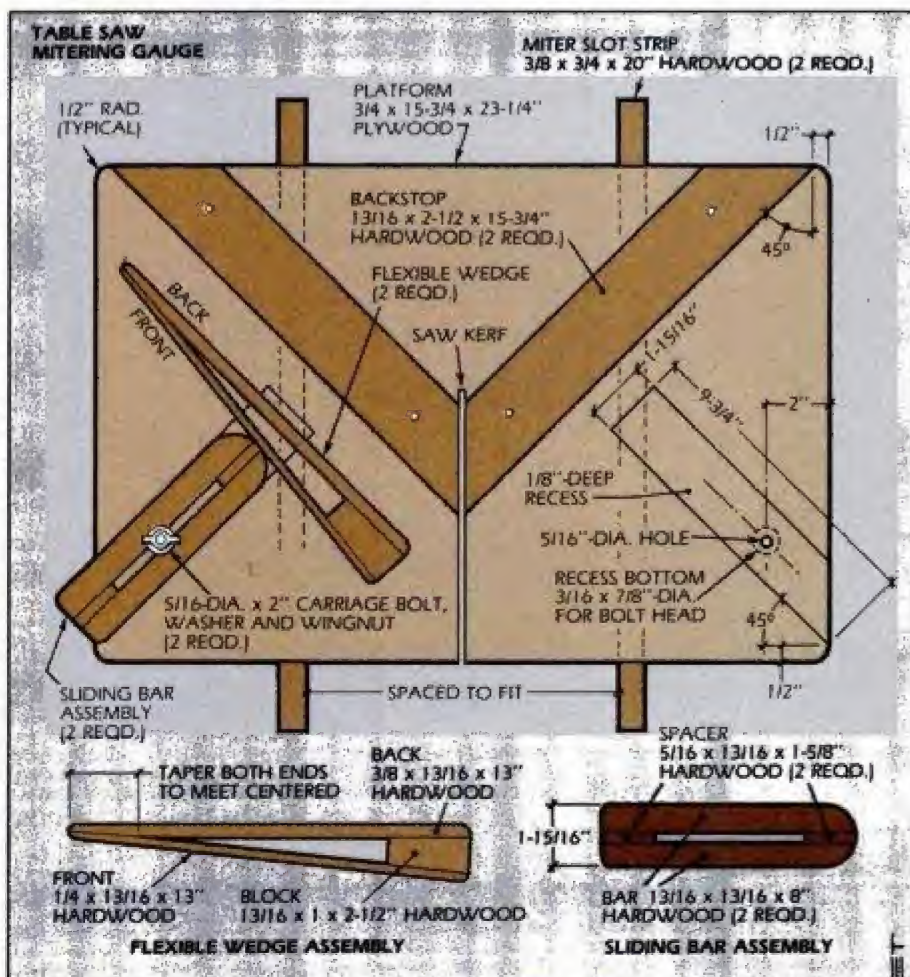
To use this jig, position the work-



The table saw mitering gauge makes easy work of cutting precise 45° miter joints. Attach hardwood strips to the underside of the jig to fit into the saw table miter grooves which lock the jig accurately on course. The workpiece is held in place by the flexible wedge.

piece between the backstop and the sliding bar. Then, place the wedge behind the workpiece and slide the bar tightly against it. Finally, tighten the wingnut in order to lock the bar and hold the workpiece securely in place.

Be certain that you install the flexible wedge with its back against the workpiece edge. Spray the saw table miter grooves with silicone lubricant to allow the jig to slide freely.



6 Sanding attachments

Here are two jigs that allow a lathe to perform sanding operations. One jig has a vertical worktable for use with a 3-in.-dia. (maximum) sanding drum. The second attachment features a horizontal table supported by a pipe and



Attach the vertical sanding jig to the lathe bed when using a drum sander (top). The horizontal jig is held by the toolrest clamp for disc and drum sanding (above).

flange for using either a drum or disc sanding accessory. Install the vertical jig to the lathe bed with the two clamping pads under the bed. Then, tighten (Please turn to page 110)

(Continued from page 109)

VERTICAL SANDING JIG

1/2 x 12 x 12" PLYWOOD

1/2 x 2-1/4 x 12" PLYWOOD (2 REED.)

1-1/2" RAD. (TYPICAL)

3-1/4" DIA. HOLE

2-1/4"

6"

CENTER OF LATHE

ADJUST TO FIT LATHE

5/16" DIA. HOLE

3/4 x 2 x 4-3/8" PLYWOOD (2 REED.)

3/8 x 1-3/8 x 2" PLYWOOD (2 REED.)

5/16" DIA. x 2-1/2" CARRIAGE BOLT, WASHER AND WINGNUT (2 REED.)

Diagram illustrating the top view of the platform with dimensions and components:

- Platform dimensions: 5" (width) and 3-1/2" (length).
- Platform material: 3/4" x 7 x 15" PLYWOOD.
- Platform corner radius: 3/4" RAD. (TYPICAL).
- Fastener: 3/4" NO. 14 FH SCREW (4 REQ.).
- Flange: 1/2" GALVANIZED STEEL FLOOR FLANGE.
- Threaded pipe: 1/2"-DIA. x 1-1/2" GALVANIZED STEEL PIPE THREADED ON ONE END.

This auxiliary table bolts to an existing drill press worktable to provide a large work surface for supporting oversize workpieces. In addition, the table features an adjustable fence for exact, repetitive boring and a center hole for



Position the adjustable fence for exact, repetitive boring (left) with the solid back-up block in the table cutout. Insert the sanding block for use with the drum sander (right).

drum sanding. Cut and assemble the jig as shown. Note that the table center has a $4\frac{1}{2} \times 4\frac{1}{2}$ -in. cutout for holding backup blocks.

Insert a solid backup block for clean through boring. Replace the block as necessary.

Use the block with the round center

cutout for sanding with a 3-in.-dia. drum sander. During sanding operations, place the spacer block between the auxiliary table and the metal drill press table to provide bottom clearance for using the drum's entire abrasive surface.

(Please turn to page 112)

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8 Router surfacing jig

Gluing up stock for use as tabletops and countertops yields rough, uneven surfaces, which require exhaustive hand planing and belt sanding. But you can use this jig and a router with a mortising bit in order to get a smooth, finished surface.

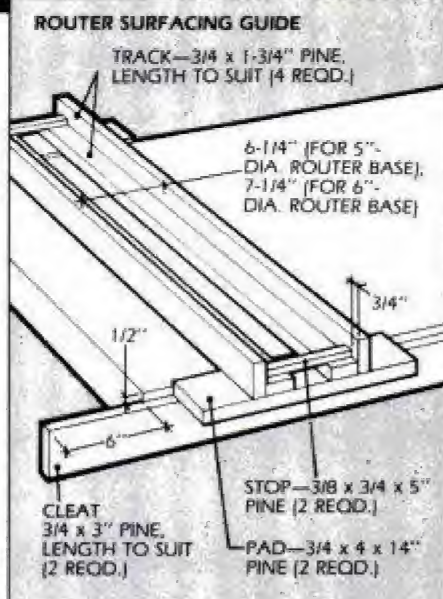
The jig consists of two tracks which guide the router over the workpiece. First, glue and nail a pad to each end of the track as shown. Then, tack-nail a cleat to both workpiece edges $\frac{1}{2}$ in. below the top surface. The cleats support the pads and hold the router to establish a uniform cut.

Next, adjust the depth-of-cut to $\frac{1}{16}$ in. below the surface's lowest spot.



Use the router surfacing guide to level the uneven surface of glued-up stock. Tack-nail cleats to the workpiece edge to support jig. After routing one area, move jig to next.

Move the router back and forth with the jig clamped in place. Reposition the jig to surface-clean a new area.



9 Horizontal boring jig

This jig utilizes a portable drill and a Portalign drill guide for horizontal boring in workpiece edges. It has a crank-screw elevating mechanism for quick, accurate drill positioning. First, cut all the parts according to the materials list and construct the jig as shown. Make the elevating nut bracket in two parts to permit sawing the hex-shaped cutout which holds the nut. Hold the nut in place with epoxy glue (see detail 4). Install the $1\frac{3}{4}$ -in. ledges as shown for

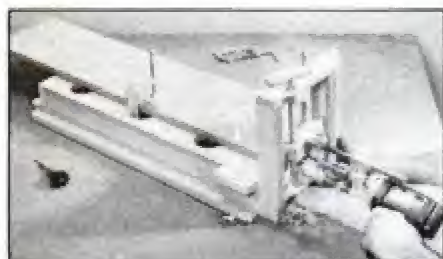
clamping oversize work or pieces that don't line up with the clamping holes. To use, clamp the workpiece in place and screw the Portalign guide, with the

drill attached, to the elevating slide. Crank the handle until the drill bit aligns with the desired boring location.

PM

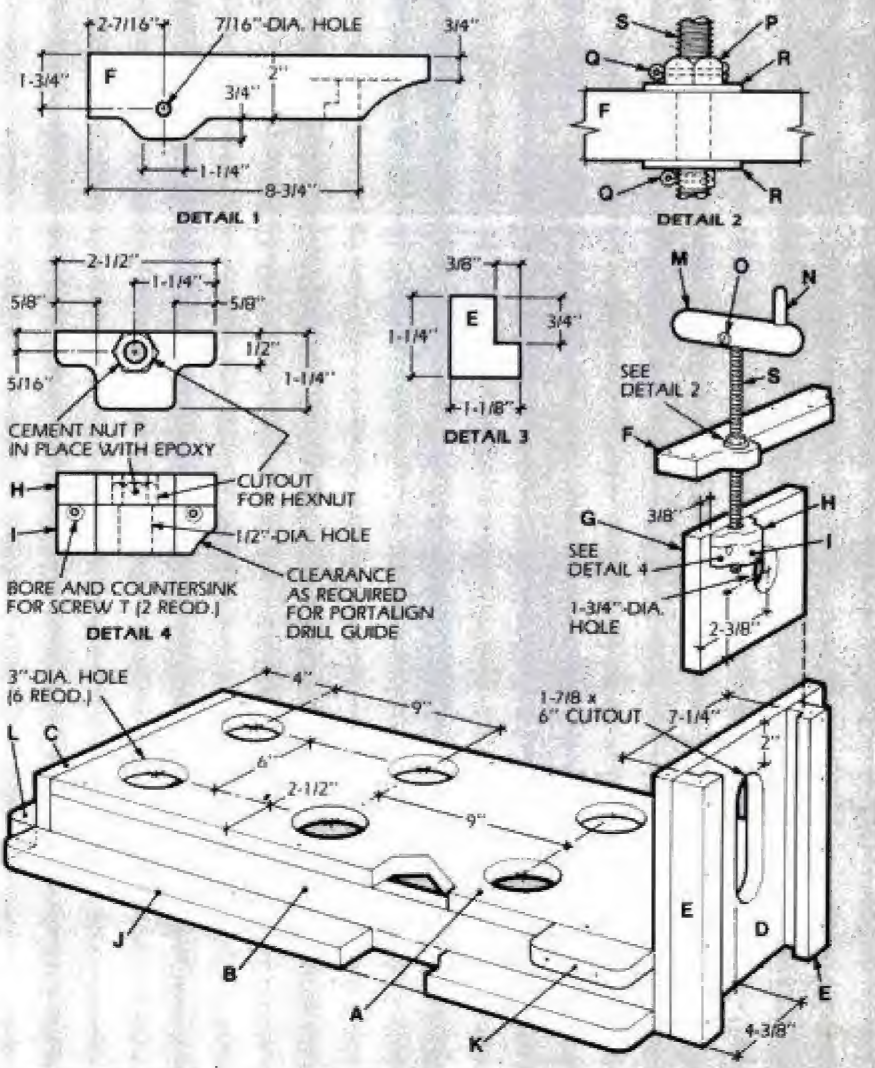
MATERIALS LIST—BORING JIG

Key	No.	Size and description (use)
A	1	$\frac{3}{4}$ x 11 x $29\frac{1}{4}$ pine (top)
B	2	$\frac{3}{4}$ x $2\frac{3}{4}$ x $29\frac{1}{4}$ pine (side)
C	1	$\frac{3}{4}$ x $3\frac{1}{2}$ x 11 pine (end)
D	1	$\frac{3}{4}$ x 11 x 11 pine (front)
E	2	$1\frac{1}{8}$ x $1\frac{1}{4}$ x 11 pine (rail)
F	1	$\frac{3}{4}$ x $2\frac{3}{4}$ x 11 pine (cover)
G	1	$\frac{3}{4}$ x $5\frac{3}{4}$ x $7\frac{1}{4}$ pine (slide)
H	1	$1\frac{1}{2}$ x $1\frac{1}{4}$ x $2\frac{1}{2}$ cherry (nut retainer)
I	1	$1\frac{3}{16}$ x $1\frac{1}{4}$ x $2\frac{1}{2}$ cherry (rod guide)
J	2	$\frac{3}{4}$ x $1\frac{3}{4}$ x 30 pine (ledge)
K	2	$\frac{3}{4}$ x $1\frac{3}{4}$ x 4 pine (ledge)
L	1	$\frac{3}{4}$ x $1\frac{3}{4}$ x 11 pine (ledge)
M	1	1"-dia. x $4\frac{1}{2}$ " hardwood dowel (crank)
N	1	$\frac{3}{8}$ "-dia. x 2" hardwood dowel (handle)
O	1	$1\frac{1}{4}$ " No. 6 rh machine screw, hexnut
P	2	$\frac{3}{8}$ " hexnut
Q	2	Cotter pin
R	2	$\frac{3}{8}$ "-i.d. washer
S	1	$\frac{3}{8}$ "-dia. x 9" threaded steel rod
T	2	1" No. 8 fh screw



Attach a Portalign drill guide to the jig for boring holes in workpiece edges. Use the crankscrew mechanism to raise or lower the drill for exact, repetitive boring.

HORIZONTAL BORING JIG





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WOOD BEAMS ADD WARMTH

(Continued from page 103)



Install divider beams after main beams are in place. Snap on interlocking clips to secure divider beams. Wire only main beams.



Finally, maneuver the ceiling panels gently into place. Cut the panels with a crosscut handsaw to fit around room perimeter.

is marked. Then, snap a chalkline from one mark to the next on each wall.

Now, install the L-shaped oak side rails which hold the main beams and divider beams at the wall. First, line up the side rail bottom edge with the chalkline. Then, nail the rail to the wall studs with 2-in. common nails. Prebore the rail to prevent splitting.

Next, insert acoustical lags (see photo) or screw eyes into the ceiling joists every 4 ft. along the main beam positions. Then, attach lengths of 16-ga. steel wire to the lags or eyes for hanging the main beams. If the room is more than 8 ft. long, join two main beams with an extension clip. Also, place one hanger clip onto the beam for each wire and thread the wire through the eyelet in each clip to hold the beam.

Install the divider beams perpendicular to the main beams. Then, check the beams for level. Now, hire a licensed electrician to wire in the lights. Finally, tilt the ceiling panels through the beams and gently into position.

—Joseph Truini

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BACKPACK BALLOONING

(Continued from page 77)

balloon and try to stay under it with their cars—a tough job if the balloon is over an area with few roads.

I was at about 300 feet now and I had to make a decision. The wind was blowing at about 5 mph, and I was headed toward an open field. If I didn't land in the field, there were houses and tall power lines directly ahead of me. I would have to go another mile or so before I could attempt a landing. By then my left leg might be totally asleep.

I decided to shoot for the open field. I pulled a handkerchief out of my pocket and dropped it. It was attached to my belt with a 10-foot string. That was a signal that I would attempt a landing.

I could see one of the crew up ahead stop his car and jump the fence into the field ahead of me. I was at about 75 feet and slowly descending. I gave the burner short intermittent blasts to keep from falling too rapidly.

Attached to my harness was a blue bag with a 100-foot nylon rope inside. I opened the bag and tossed the rope down. The crew member grabbed the rope to keep the wind from blowing me farther down the field. Now all I had to do was descend this last 75 feet.

The ground was rushing up faster than I liked. Fifty feet. Twenty-five. Ten. Oh man. I'm going to hit hard.

No. My feet touched the ground and I fell down.

Glad to be down

I pulled on a red line which opens a flap in the top of the balloon. This let the hot air escape and the balloon collapsed on the ground, a large, colorful blanket of deflated ripstop nylon. I unhooked myself from the balloon and stood up. I was glad to be down.

But it had been fun. I had been airborne about 20 minutes. I had experienced the exhilaration of flying and the fear of falling. And I had flown something I didn't even know existed a few weeks earlier—a one-man balloon.

You can fly one, too. The Cloudbopper is made by Colt Balloons Ltd. in England. It is imported into the United States by Early Winters, 110 Prefontaine Place S., Seattle, Wash. 98104-9977. The Cloudbopper costs \$5,000, and the parachute harness is a \$250 option. Early Winters plans to put more padding in it to help prevent circulation problems in the legs.

A virtually identical balloon, called the Drifter, is imported by Hoverair Ltd., 1385 Fairfax Dr., Unit B, San Francisco, Calif. 94124. It is also made by Colt Balloons. It costs \$5,975, which includes pilot instruction.

Just remember, wherever the wind blows, that's where you go. **PM**

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THROUGH THE ICE

(Continued from page 90)

should know about. The discovery of deep freeze dates back to a day in 1973 when a college student drove across what he thought was a snowy field in Michigan. The "field" was a lake, and his car plunged in, trapping the man.

It was well known that in freezing water, hypothermia can kill in minutes. Although they knew the man was dead, rescuers dove for the body, brought it up 40 minutes later and put it in a hearse. Then, suddenly, it burped. Undertakers know this can happen.

And clearly the man was dead: His eyes were fixed and staring, and he was a blue color. All the same, the man was rushed by ambulance to a hospital. He was revived.

He had been saved by what is now called "CPR," or cold protective response. Since then, says Pennsylvania water rescue specialist Virgil Chambers, there have been 200 cases proving that many who "drown" are actually asleep in a protective freeze and can be brought back to life with no significant evidence of brain damage.

In New York's Adirondack foothills last winter two men went through the

ice in a snowmobile. "I felt the back end squash down," says Conservation Officer Larry Johnson. "I gunned it wide open, but we went down backward."

About 80 men were on Great Sacandaga Lake. One left his license ashore and Johnson offered him a ride on the rear of his Ski-Doo Élan to get it. As a courtesy to fishermen near shore, he swung a wide arc to the left—straight into a trap. A stream in the lake had eroded nearly all the snow-covered ice.

When the rear of a snowmobile goes in, sudden gunning sometimes helps. And sure enough, when Johnson hit the gas, the Ski-Doo leaped 30 feet ahead. But then it wearily poked its nose straight at the sky and went down stern first. The passenger leaped off to safety. But no one could help Johnson.

As the machine dove, he heard the engine still sputtering. When water came to his pistol belt he braced against the running boards of the snowmobile and kicked off—hard. He wanted to get away. The track was still churning. He didn't want the machine to fall over backward on him.

Johnson began to yell. Fishermen tried to help, but kept breaking through. He tried to tread water, but pistol, bullets, handcuffs and winter hat dragged him down. Then he sank for the first time, closing his eyes against excruciating cold. His boots hit bottom; he knew he was about 10 feet deep.

Lungs bursting, Johnson kicked hard, only to come up to dull grayness. He was under the ice. He saw ripples, found the hole, gulped air and grabbed a small chunk of ice—but sank again. This time he hit bottom so hard one boot stuck in the mud. He kicked so hard his foot tore free from the boot. He rose to the surface, went down, came up and went down a fourth time.

Help from a fisherman

Rescuers gave up hope, but they said a fisherman named Brent Zievak threw himself flat on the ice and headed toward the hole, wriggling on his belly like a seal, spreading his weight.

Advancing inches at a time, he neared the hole. When he peered over the edge, he could see Johnson on the bottom, waving his arms and still fighting to get up. It was a creepy sight. Zievak prepared to go down to get him.

But then, Johnson made it to the surface a fourth time. A rope hit his chin. He saw Zievak wriggling backward to keep the ice from collapsing.

In desperation, Johnson saw the rope slip through his numb fingers. And then they hit a knot—and held. He heard shouts: "Get your elbows on the ice, so we can drag you!" He tangled the rope around his wrists. Then he felt his chest scraping and he was dragged 30 feet, in Zievak's tracks.

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He came to in someone's house. People were removing his wet clothes, but no one could release the gun belt. A woman was rubbing him with hot towels. Next, he awoke in a hospital. A doctor was saying: "You were very lucky."

Born of such cases is a new science: ice-crash survival. But the best report comes from two brave investigators who put their lives on the line in Minnesota's frigid Christmas Lake last winter. They volunteered to drive a Chevy wagon through the ice. The test was managed by Buzz Fawcett, former underwater photographer for sailor Irving Johnson and his famed schooner *Yankee*. It was sponsored by an insurance company.

Five discoveries

As the Chevy neared the hole, running at 30 mph, all thought the two divers, Jerry Provost and Greg Hegi, an instructor, would have an easy time. Instead, they faced sheer horror, but made five discoveries.

1. When the car hit water, the shock was like a collision. Despite seat belts, Provost and Hegi were hurled against the dash. They were stunned, but could have jumped out then. "But our job was to stay," says Provost, a veteran Army diver.

2. As the car followed its engine down, a shocking blast of ice exploded through the windows, which had been left open for escape. Ice filled the car, blocked tailgate escape, knocked them dizzy, tore their masks off and ripped the tubes from a rear-seat air tank from their teeth. Provost's jaw swelled. The cold closed their eyes.

3. It became hard to think and breathe. Provost, used to danger, was scared.

4. As the car cushioned out, mud followed the ice. "It was like being pushed by Jell-O," Provost says.

5. In a final surprise, the car began a slow end-over roll, landing on its roof.

The trouble now was that they didn't know they were upside down. Mud filled their eyes, noses and mouths. "We were supposed to pat shoulders to keep in touch," Provost says. But when he groped through mud, Hegi was gone. He thought: "Hegi's out."

Provost found his air, bit the valve and breathed deeply. Now, he dug, not knowing where the window was.

And then, with no warning, a hand squirmed through the window. It clawed his face. Provost grabbed it and was dragged out the window. A rescue diver had found him. Up in sunlight at last, he searched faces. There was no Hegi. Still in the car, Hegi was buried alive in mud and upside down. He couldn't find his air line. He held his breath, but his lungs were exploding.

He felt a kick. "Jerry's going out the

window," he thought. "That must be the way to go." Hegi tunneled under the steering wheel, thrashed wildly. "You're panicking," he told himself.

Then Hegi, too, felt a hand. Gratefully, he grabbed it and shook it. Just in time, a rescue diver fed him air. Then Hegi saw sunlight, swam up with delight—and bumped his head hard. He hadn't found the hole at all. He was trapped under the ice.

And then he felt something on one leg. As an afterthought that morning, he'd tied a small air tank to his leg and had forgotten about it. Now he drew air from its hose. Hegi saw a shadow: His

diver had come back, hunting. Hegi grabbed his foot, then felt himself moving. Others up top were dragging them along on a rescue rope, not to the hole he'd missed, but to another, yards away. He came up at last.

All this, Fawcett captured in one of the most remarkable rescue films ever made. It's being distributed to sports clubs, firefighters, police and rescue squads.

"We learned that there *is* terrible action and panic," Hegi says. "We were trained divers. I don't think anyone else could have escaped. You must leave your car before it sinks." **PM**

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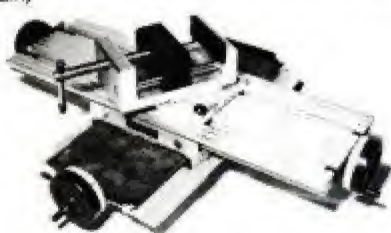
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TEMPO AND TOPAZ

(Continued from page 95)

according to one Ford spokesman, a service bulletin issued in August tells dealer mechanics how to cure the problem.

Assembly line changes also instituted in August keep later-model transmissions from shifting so harshly.

Lower gas mileage

We heard a few complaints, too, about lower-than-expected gas mileage.

Ford estimated a top EPA fuel rating of 29 mpg city, 44 highway. According to the owners we queried, however, the composite average for manual-transmission cars came to 25/32—roughly 27 percent below the projected mark.

On the other hand, all but about 6.5 percent of our owners praised these cars' performance and felt that power was more than adequate. For example, a Michigan insurer wrote, "I've owned nothing but V8s for years and was a little leery about buying a four-cylinder car. But the 2300-cc HSC high-swirl engine, coupled with the five-speed manual transmission, has proved to be a good combination. I'm pleased with the car's acceleration, and there's rarely any problem in maintaining a cruise. I'm averaging just around 31 mpg overall."

Similarly, from a Wisconsin manager: "The Tempo engine will do anything I ask. It instantly supplies power, and the automatic transmission is set up to serve the driver under all road conditions. I do leave the gear selector in SECOND on hills, though, to maximize power."

Speaking of handling, a North Carolina salesman said, "Front-wheel drive will give me better handling in snow and mud this winter." And a New York tobacco dealer: "Handling, cornering, acceleration and performance are comparable to my friend's BMW. I've driven and ridden in lots of sports cars, and I get this sports-car feeling when I'm behind the wheel of my Topaz."

We heard the usual complaints about Ford's positioning of the horn "button" on the end of the turn-signal stalk. "Another Ford 'better idea,'" chided a Florida housewife. And several drivers said they kept turning on the headlight toggle switch with their right knee when climbing into the car.

But by and large, the vast majority of owners had no complaints and said nothing but good things about their Tempos and Topazes.

Complaints seemed to be relatively minor and, since we surveyed owners very early in the model run, problems tended to be of a teething nature. Even

so, some owners weren't sure they'd buy the same cars again. About 65 percent said they definitely would, but a whopping 25.4 percent remained uncertain. It's a segment of the market

with lots of choices, and many Tempo/Topaz owners felt they might shop around the next time.

One woman, though—a claims examiner for the state of Michigan—had

no qualms at all. "I've always driven luxury cars, mostly Cadillacs, and I find my Tempo to be equal in quality and ride, with much better economy and performance." **PM**

SUMMARY OF 1984 FORD TEMPO AND MERCURY TOPAZ OWNERS REPORTS*

Total miles driven 857,230	Specific likes:	Workmanship opinion:	Dealer service opinion:
Average miles per gallon	Styling 45.3%	Excellent 51.3%	Excellent 28.4%
Automatic transmission	Handling 43.4	Good 43.3	Good 47.9
In town 23.1	Economy 36.2	Average 4.7	Average 19.0
On the highway 26.6	Ride 35.8	Poor 0.7	Poor 4.7
Manual transmission	Comfort 32.1		
In town 25.0	Trunk space 14.3	Comfort opinion:	Number of vehicles owned:
On the highway 32.8		Front seats	This car only 38.9%
Transmission choices:	Specific dislikes:	Excellent 57.8%	Two cars 38.6
Automatic three-speed 67.8%	Transmission and rough shifts 23.5%	Good 43.3	Three cars 14.0
Manual four- or five-speed 32.2	Lower-than-expected mpg 17.6	Average 3.5	Four or more cars 8.5
Nameplate choices:	No complaints 16.2	Poor 0.3	
Mercury Topaz 52.4%	Rough shifting 14.4	Rear seats	Makes of other cars owned:
Ford Tempo 47.6	Sluggish acceleration 6.3	Excellent 39.2	Ford 46.6%
Series choices:	What changes would you like?	Good 51.6	Mercury 19.5
Tempo GL 39.5%	No changes 30.0%	Average 8.8	Chevrolet 12.1
Topaz GS 26.7	Better fuel mileage 9.1	Poor 0.4	Pontiac 9.2
Tempo GLX 14.8	Reposition headlamp switch 8.7		Buick 6.9
Topaz LS 14.8	Smoother automatic transmission shifts 6.5	Had any mechanical trouble?	Would you buy another Tempo or Topaz?
Tempo L 4.1	More horsepower 6.5	Yes 54.7%	Yes 65.4%
Body style choices:	How much did you pay for your Tempo?	No 45.3	No 9.3
Four-door sedan 75.2%	Average \$9,190	What type of trouble?	Maybe 25.4
Two-door sedan 24.8	Range \$7,500-\$11,136	Rough-shifting automatic transmission 19.7%	Would you buy another Ford/Mercury?
Why did you choose this car?	How much did you pay for your Topaz?	Electrical 12.4	Yes 81.3%
Styling 50.4%	Average \$9,483	Fuel induction 12.4	No 3.2
Economy 34.7	Range \$7,800-\$11,320	Air conditioner 10.2	Maybe 15.5
Size 17.3		Dealer repairs satisfactory?	Age distribution of owners:
Front-wheel drive 16.5		Yes 73.2%	15-29 years 20.6%
Handling 14.9		No 26.8	30-49 years 35.4
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*Percentages might not equal 100% due to rounding or insufficient data.

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MAKE LEARNING FUN

(Continued from page 81)



Home Baby Sitter is on cartridge for the VIC 20 and will entertain as well as educate the very young. Alphabet, numbers and cartoons are shown on-screen. Meanwhile, a musical background, the *Alphabet Song*, adds to the fun. Older children will enjoy the counting and drawing games.

of program is one of the best ways to introduce a child to a computer.

Bumble Games (The Learning Co., for Apple II, Disk, \$39.95) includes the concept of a number line and, later, of two-dimensional graphing, which can be grasped by surprisingly young children if they are introduced to the idea gently. This program is an excellent example.

First, kids can try simple guessing games, for instance, the location of a hidden treasure on a map. Then, as the child's skills progress, the games become more challenging. By the end of the disk, the youngster should be able to draw fairly complex shapes by plotting points on a graph, which the computer will then automatically connect with lines. *Bumble* is an interesting combination of art, education and math.

Beginning Grammar (Texas Instruments. Plug-in cartridge, \$24.95) uses extensive color, graphic effects and sound cues to introduce nouns, verbs, pronouns, adjectives, adverbs and prepositions/conjunctions. Each unit begins with a definition of the part of speech involved and includes examples.

The required responses and interaction with the computer start off simply.

(Please turn to page 122)

advantage of being up and running the instant the computer is turned on. Cassette software, on the other hand, must be loaded into the computer from a cassette player. Depending on the particular program, the loading can take anywhere from a few seconds to several minutes. Disks are quick, but fragile.

Most fun programs enhance the user's interest with some sort of electronically generated sound or tone that's reproduced either from the cassette player or the TV's speaker.

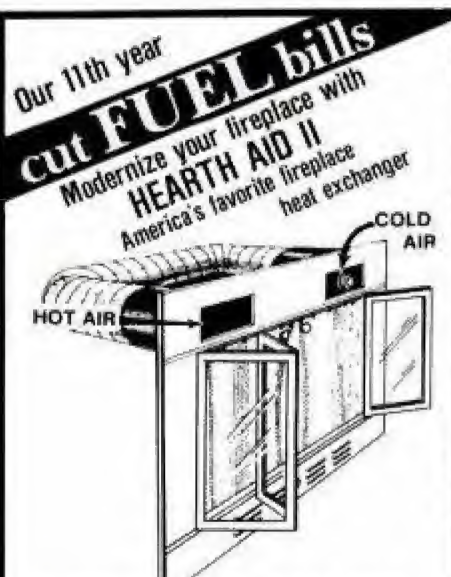
While the marketplace is filled with hundreds of educational but fun programs, few are really worth the \$20 to \$60 price. From the best programs, we've selected a handful that illustrate what's available for the most popular home computers.

Apple Presents Ernie's Quiz (Apple Inc. Disk, \$50) is made in conjunction with Children's Television Workshop. Apple has released a number of fun-filled and muppet-filled games for young children. All feature multiple games per disk, all of them chock full of familiar characters.

One program, called *Face-It*, lets kids make hilarious faces by using the paddle or joystick to choose from combinations of features. Everything from the size of the head to the color of the hair can easily be varied by a preschooler, making this one of the few fun games where no reading is required. This type



Vocabulary Builder tapes are from Radio Shack for its Color Computer. They use cassettes which contain both a computer program and recorded speech. Once the program is running, the computer controls the voice narration. Screens above represent some of the easy-to-follow text and graphics that make this program a standout.



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PROGRAMS THAT MAKE LEARNING FUN

(Continued from page 122)

pie Inc. Disk. \$50) is another offering from Apple's line of the Children's Television Workshop series. This disk features a game called *Animal Quiz*. The Apple's low-resolution graphics present a series of hidden animals that have to be identified by the child.

First, the screen is filled with video confetti, which slowly begins to clear to a recognizable image. When the child knows what the hidden picture is, he hits the computer's escape key.

If the guess is right (either typed in by the child or a helpful adult), the screen will clear to show the complete picture. If wrong, the gradual clearing process continues. Cute comments (read out loud by an adult) enliven the guessing.

Stickybear ABC (Xerox Corp., for Apple II. Disk. \$39.95) has the best graphics we've ever seen in children's software. Part of a new series of software featuring Stickybear, this disk will make learning the ABCs as much fun as any story time.



Math Hurdler (top) is part of the *Educational-Recreational II* tape for use on the VIC 20. An animated runner helps the child learn different mathematical concepts. **Early Learning Fun** is a plug-in cartridge made for the TI-99/4A (bottom). It will teach children everything from shapes and colors to just having fun with cartoons.

Stickybear will show you many objects, all beginning with the letter a child presses on the keyboard. Each letter has more than one picture associated with it, so the game doesn't become boring even if the same key is pressed several times. The Stickybear package also contains a high-quality storybook with a sturdy binding and a poster for the computer room wall. All in all, Stickybear is certain to make friends with your own preschooler.



Delta Drawing (top) is a language similar to Logo but easier. It's specifically designed so that children can draw complex shapes on the Apple II computer. **Golf Classic** (bottom) is a cassette program for the Atari machines which will teach older children the concepts of distance, measurement and angles. The program uses a video golf course.

States and Capitals (Atari. Program cassette. \$14.95) is a program in which a child tries to fill in the map of the United States. The game starts by displaying the outline of the country.

The computer randomly selects the outline of a state and places it in its proper geographic location on the map. The location of the capital is represented by a dot within the outline. The player must provide the name of the state and its capital. If the answers are correct, the outline is filled in and the computer randomly selects another state outline. If the player doesn't know the correct answers, they are displayed on the screen. The computer then selects another state outline.

Home Baby Sitter (Commodore, for VIC 20. Plug-in cartridge. \$29.95) is an introduction to letters, numbers and funny-face cartooning.

In one mode, the whole alphabet is placed on the screen block by block to the accompaniment of the *Alphabet Song*. In the second mode, there's number practice as high as 20, involving counting and identification. The third mode is a fun break—drawing funny faces in color. The action is fast and the musical tones simple and cute, intended to both entertain and hold the attention of the very young.

Vocabulary Builder (Radio Shack. Voice and program cassette. \$9) in-

cludes two cassettes which use pictures, text and recorded speech and sound effects to build a child's vocabulary. One tape is *Words About Things*. The other is *Words That Act*.

The computer interactively controls the tape recorder in response to the TV screen display and the child's answers. A correct answer moves the child on to the next question. Wrong answers are beeped and restated. The required response varies. Sometimes, it's pressing the correct number key. At other times, the correct word must be typed in. The taped narrator, who is heard through the TV's speaker, expands on each screen question and responds to the child's input. This is a delightful, well-thought-out and well-done package.

Ator the ABC Gator (Timex, for Timex/Sinclair 1000. Cassette program tape. \$12.95) is an action program intended to introduce the young and very young to the computer. The object is to get a small alligator to gobble a letter by pressing the right key. For the more skilled player, there's a swamp game in which the gator works its way through a maze to get back to its home. To make things easier for the very young, the trail in the swamp is marked by connecting lines between the letters. This is an all-fun game. There's no pressure, no beeps, boops or other sounds to indicate error. The child simply keeps trying until the gator chomps the letter.

Moptown (Apple Computer Inc. Disk. \$50) has citizens who are combinations of short or tall, fat or thin, red or blue. It's up to the player to decide who is who. Through a number of entertaining games with cute graphics, the child is introduced to deductive reasoning.

The first games are the easiest. The player decides which Moptown citizen is different from others on the screen. Then, the keyboard is used to make different ones exactly the same as the others in all respects. Finally, regular parades of creatures are shown. It's up to the child to deduce the hidden rule and figure out what the last character in line should look like. For children already in primary grades, it's the best introductory software for the Apple.

Educational-Recreational II (Creative Software, for Commodore VIC 20. Cassette program tape. \$22) is a combination package that includes an educational game called *Math Hurdler* and an escape game called *Monster Maze*.

Math Hurdler is for practice in addition, subtraction, multiplication and division at three user-selected levels of difficulty. On the screen, a simple arithmetic problem is displayed while a runner starts a hurdle race. The hurdles represent the math problem. If the player keys the correct answer before the runner reaches the hurdle, the run-

ner leaps over the hurdle. If the answer is incorrect, or too late, the runner crashes into the hurdle, then gets up and resumes the race. The user can change an answer up until the time the runner reaches the hurdle.

It's a high-pressure game that builds quick thinking and reflexes. But if you relax for a moment, crash.

Early Learning Fun (Texas Instruments. Plug-in cartridge. \$24.95) gets to the nitty-gritty of early childhood education. It teaches numbers, shapes, sorting and the alphabet.

Some of the work pushes the child to think a little harder. In the sorting unit, the child must pick the odd-man-out from shapes, color and animal/vegetable. In the alphabet, the child must match a specific object to a displayed letter by matching the first letter of the object's name to the display. *Early Learning Fun* is a powerful early childhood program with excellent graphics, color and electronic sound effects.

Delta Drawing (Spinnaker Software, for Apple II computer. Disk. \$49.95) is a computer language with some similarity to the popular Logo language. But *Delta Drawing* is only graphics-oriented and enables even very young children to draw complex shapes and pictures on the Apple's screen. In its easiest mode, the program draws lines and colors in shapes in response to simple one-key commands. In this mode, it's like an electronic paintbox.

Then it'll remember the shapes already drawn and will redraw them on command. In this way, simple programs are formed. And older children will enjoy programming shapes as sub-routines in larger pictures.

Golf Classic (Edufun Div. of Milliken Publishing Co., for Atari. Cassette program tape. \$22) is a regulation golf course on your TV, with 18 holes, water hazards, sand traps and out of bounds. The screen shows a unit of stroke, a compass and the position of the ball.

The player estimates how hard to hit the ball (number of strokes or units) and the direction in degrees (the angle). The screen shows the track of the ball and where it lands—on the green, in water, in sand or somewhere out of bounds off the screen. Each completed hole brings up a different layout for the next hole. Scoring is done manually on a card, just like you would on a real golf course. *Golf Classic* is especially good at teaching older youngsters how to estimate distance, units and direction.

While a computer can be of great worth to an adult, it can be even more important to a child. It can be a tireless teacher as well as an ever-ready-to-play friend. If you already have a youngster in your home, maybe you should consider adopting a computer. **FM**

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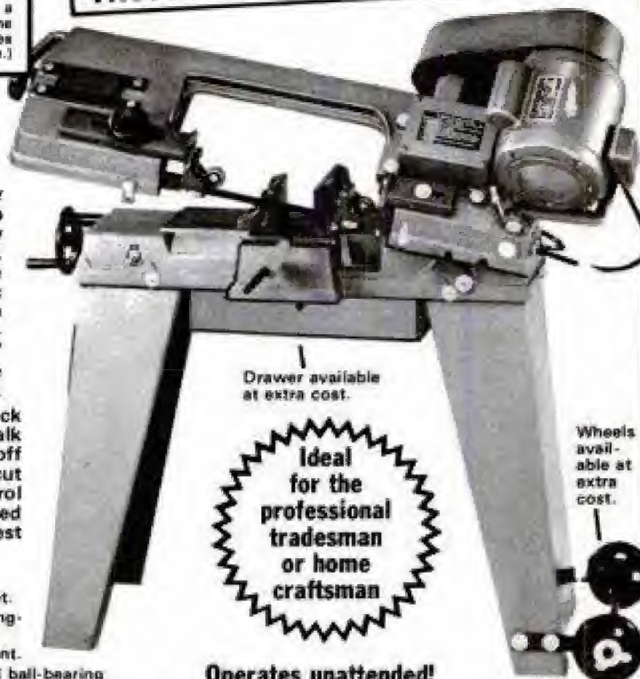
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SPACE-AGE CROSSBOWS

(Continued from page 82)

mounting the prod on the stock and aligning it. Most are held in special fittings tightened with Allen screws.

Allen screws for mounting the prod? These are the least of the modern innovations. The prods themselves are often made of composites such as graphite fibers in resin, which is lighter and springier than steel.

The hot new combination is a composite material prod with pulleys for a compound stringing arrangement (makes the string last longer, drives the bolt faster, and is easier to pull back), and a polypropylene stock. Others have skeleton stocks made of aluminum. One design, the Commando, bends in the middle to operate cocking levers.

Most of the compound bows come prestrung, but others we tried required stringing after the prod was mounted on the stock.

Stringing the bow requires that the prod be bent while the loops in the string are hooked over the ends. The easy way with most straight bows is to have two stout fellows push down on the ends of the prod while you slip the loop over the end of the prod.

Scopes and sights

Telescopic sights intended for rifles are turning up on crossbows with increasing frequency. While they give a fine and precise view of the target, the 4X scope we tried on the Hank Roberts Magnum turned out to be more of a hindrance than a help.

Careful shooting from about 30 yards produced five-shot groups about 5 inches in diameter. The 4X scope has a relatively small field of view at that range, and its quarter-minute click adjustments are of questionable value. A quarter-minute click moves a rifle bullet $\frac{1}{4}$ inch at 100 yards and so would move the point of impact for the bow at 30 yards less than $\frac{1}{10}$ inch. What might work a lot better would be a 1X or 2X pistol scope. An adjustable mounting ramp could give the coarser adjustments required to center the bolts on the target.

Many of the sights supplied with the bows worked very well. The best were the open rear sights with a vertical front post.

Some form of cocking mechanism adds greatly to both the fun and utility of any crossbow. Hand cocking is not only hard on unhardened hands, it affects the accuracy of your shooting. Hand cocking, with the crossbow held upright by a foot stirrup or short bipod, is a bend-over-and-pull-back operation. You grasp the string with both hands and pull it back until it latches. It's about as difficult as picking up a 50-

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pound carton by a string around it that cuts into your fingers. With a 150-pound prod, that's not easy and with some it's virtually impossible.

Compound bows with pulleys on their strings make cocking easier by giving you the advantage of block-and-tackle leverage while drawing the string. The farther you pull back the string, the easier it becomes.

Besides being difficult, hand cocking some bows gets the string a little off center. This can reduce accuracy.

From ancient times, crossbow cocking devices have helped solve both problems. A modern version of the goat's foot lever does the job on many Barnett bows. This is an aluminum rod a little more than a foot long with an attached arm to push the string back until it latches. A lever greatly reduces the effort required and can be a necessity on bows with 150-pound prods. It hooks over two Allen screws on the frame of the bow with its arm bearing on the string. Pulling up and back on the lever pushes the string back until it latches. The twin arms of the goat's foot that bear on the string distribute cocking force equally, so the string is centered for increased accuracy.

One bow, the Barnett Commando, cocks with a system of built-in levers when you break it in the middle like a double-barrel shotgun.

Selecting a crossbow

Some stores that sell crossbows have ranges where you can shoot them. If possible, find one of these in your area so you can try several types and discover which is the best for you.

The bows we thought the most fun to shoot might, or might not, make the best choices for big game hunting. We were looking for accuracy and convenience in a sport bow. Faced with a large bear, one of the less pleasant, but perhaps more powerful, bows would have a very real appeal.

The two pistol crossbows, the Barnett Imp and Trident, are amusing toys and fine for target shooting or, perhaps, very small game taken at ranges of 10 yards or less. **PM**

SOURCES—CROSSBOWS

Balista Inc., 2821 Ashland Rd., Columbia, S.C. 29210.
Barnett International Inc., Box 934, Odessa, Fla. 33556.
Dunmark Mfg. Co. Ltd. (Astro Daco Archery), 543 Timothy St., Newmarket, Ont., L3Y 1R1.
M&M Enterprises, Box 445, Island Lake, Ill. 60042.
Martin Archery Inc., Route 5, Box 127, Walla Walla, Wash. 99032.
Ben Pearson Archery Inc., Box 7465, Pine Bluff, Ark. 71611.
Precision Shooting Equipment (PSE), 2550 14th Ave., Tucson, Ariz. 85705.
Hank Roberts, Div. Olson Industries Inc., 410 South Sunset St., Longmont, Colo. 80501.
For more information on hunting opportunities, write National Crossbow Hunters Assn., 2132 T.R. 237, Jeromesville, Ohio 44840.



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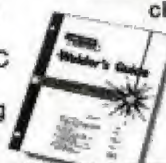
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This pine cradle with dovetail joints is an adaptation of several colonial cradles.

Build An Heirloom Cradle

BY WARREN H. GILES

My daughter was expecting her first child when I rashly offered to make a cradle for the baby similar to one that had been in our family for many years. I visited several museums until I located a cradle that had the dovetailed construction I wanted to reproduce. Using it as a basis, I made plans combining the best features of all the cradles that I inspected.

For many years, I'd been saving some wide pieces of rough-sawn eastern white pine. I planed them to the following thicknesses: $\frac{5}{8}$ in. for the sides

and ends; $\frac{3}{4}$ in. for the rockers, stretcher and bottom; $\frac{5}{16}$ in. for the hood. You could use 1-in. planed commercial lumber as is for the thicker parts, and planed stock for the thinner ones. The native pine that I selected was used in the original cradles, but cherry, walnut or other native woods also were used by colonial craftsmen.

The next step is to make full-sized patterns on cardboard or kraft paper. Use the patterns on the following page as a guide. Cut only the sides, foot and head ends at this time. The patterns for

the pieces containing curved cuts are placed on a grid. First, draw a grid of 1-in. squares on the pattern paper. Then use a sharp pencil aided by a straightedge to draw the straight lines of each part. Sketch in the contoured lines.

Next, lay the patterns on the lumber, considering the direction of the grain and interesting markings. I had to glue up lumber for the head end with carpenter's glue. Then I planed the glue line and sanded the piece with 80-grit abrasive.

I used a dovetail saw and wood chisels to make the dovetail joints. First, I laid out a practice set of dovetails on stock the same thickness as the cradle stock. The procedure I used follows: Determine the number of pins needed. I used a 2-in. on-center spacing, but adjusted this enough to have one pin at the top and another at the bottom of

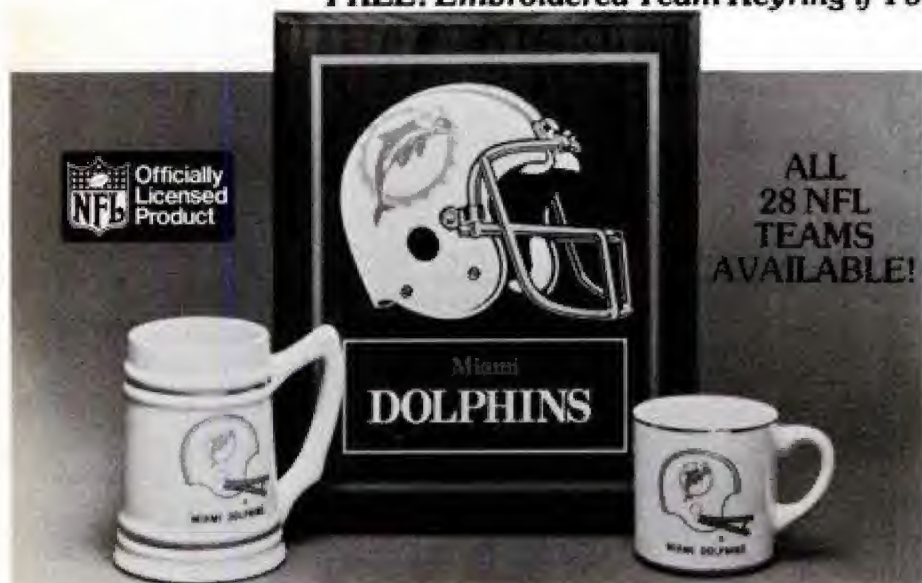
(Please turn to page 132)



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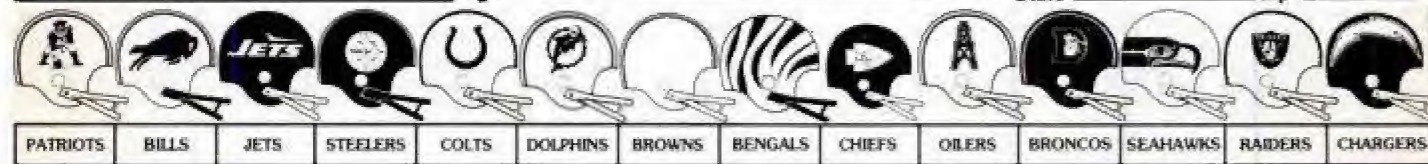
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HEIRLOOM CRADLE

(Continued from page 130)

each joint. Lay out the practice board for the pins first. Then, use the other board as a gauge to determine the depth of the pins. Make a light pencil line on both sides of the board to indicate this.

Use dividers set to measure the centers for the pins. Mark all pin centers in on both sides of the board. Use a try square to extend these marks into centerlines.

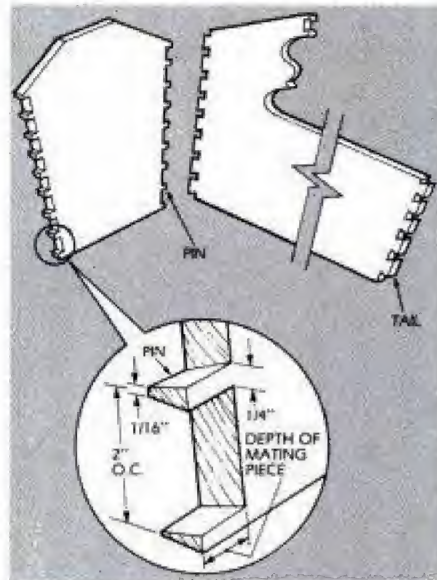
I made the pins $\frac{1}{4}$ in. wide on the inside and tapered them to $\frac{1}{16}$ in. on the outside. I worked from the centerlines with dividers to determine the width of the pins on both sides of the wood. Then I penciled in the pin outlines on both sides and board ends, using a try square and straightedge.

Cutting the dovetails

Before you cut the pins, make sure that your tools are truly sharp. Then put the board in the vise, the end with the pins upward. Cut the edge of the pins with the dovetail saw. Then lay the board on the bench and cut between the pins, using wide wood chisels. Cut both sides toward the center.

Lay out the tails by placing a practice board (that represents the cradle side) on the bench and holding the piece with pins on it in a vertical position. Outline the pins carefully with a sharp pencil. Straighten the tracings with the aid of a straightedge. Then cut the tails with a dovetail saw and chisel. After you cut these out, try fitting the parts together. A tight fit is better than a loose one.

A sharp pocketknife or a fine rasp



can be used to remove the extra wood, a little at a time. Once you have a practice set of dovetails that suits you, proceed with the cradle. There are only nine pins on each side of the head, six pins on each side of the foot and one on each side of the hood front. The top and bottom pins at each end of the joints are actually only part of a pin.

Making the handholes

You can make the handholes in the sides by boring two 1-in.-dia. holes and connecting them with a decorative cut. Assemble the sides and ends dry, in order to take final measurements for the bottom and hood front. Set a sliding T-bevel on the inside of the assembly to determine the angle for the bottom. Cut the bottom to size.

Round the top edges and handhole edges with a $\frac{3}{8}$ -in. rounding-over bit in a router. Don't extend these cuts into the dovetailed corners. Round the corners by hand after assembly. Cut the front of the hood to fit properly between the sides. Then cut the single pin in the center of each end, and cut the matching tails in the sides. Assemble parts with glue.

To ensure uniform rockers, begin by drawing only half of the pattern on stiff paper. Fold the paper and cut it so that

Not So Basic Training.

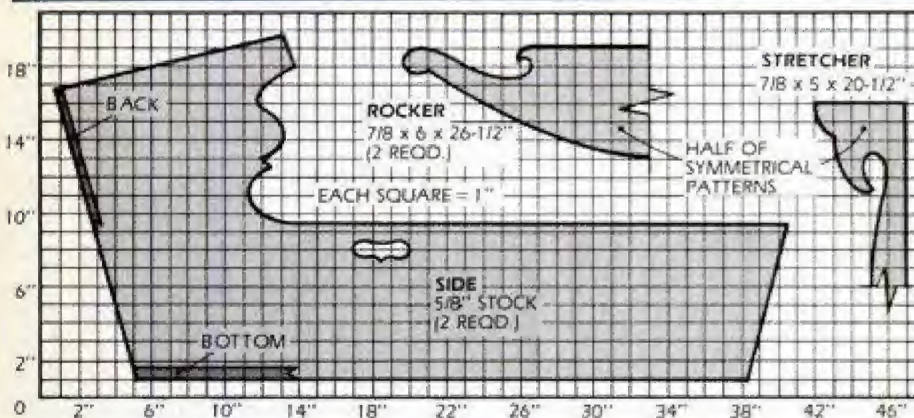
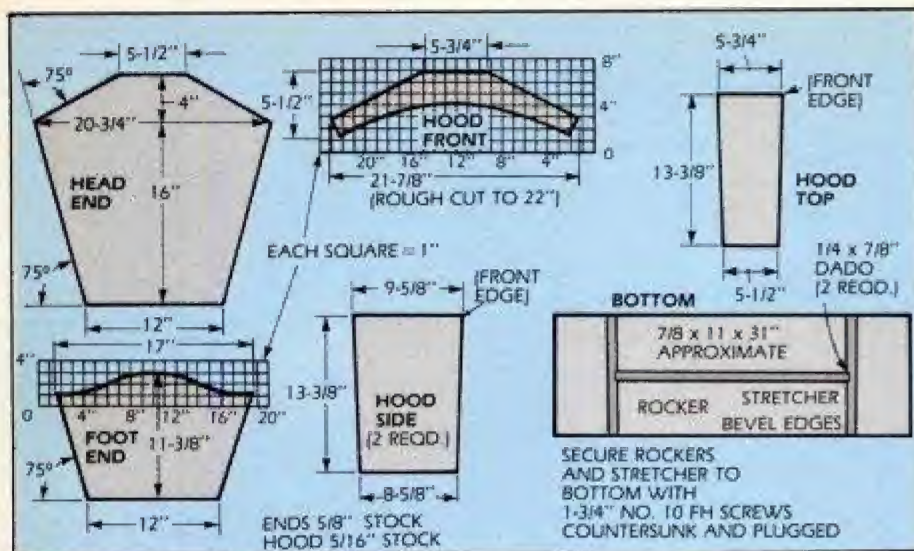
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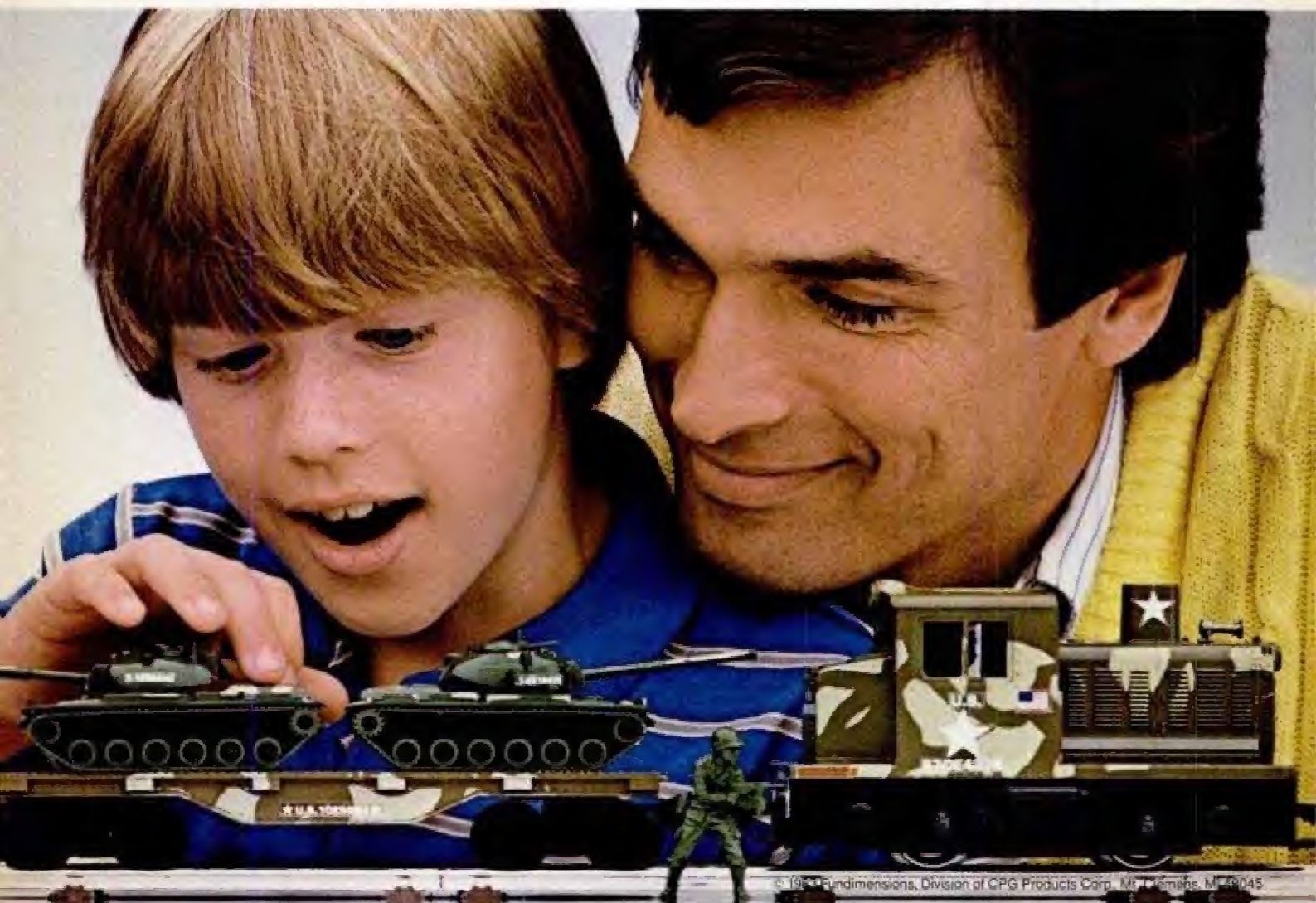
a full rocker is revealed when the paper is unfolded. Cut out both rockers at the same time on the band saw, by piggy-backing the wood blanks and nailing them together through the waste.

Cut the template for the stretcher in a manner similar to the rocker template. Cut dados 1/4 in. into the rockers to accept the ends of the stretcher. Ease the cradle sides where they come in contact with the rockers. Assemble the rockers and stretcher to the cradle, using 1 3/4-in. No. 10 flathead screws and glue. Use two screws in each rocker and three in the stretcher. Counterbore and plug the screwholes.

Cut out the top of the hood. Temporarily nail it in place. Measure and cut the side pieces, being sure to obtain the correct angle. Round the outside edges with sandpaper and assemble the hood with glue and fine 3/4-in. brads set and covered with wood filler.

Sanding and finishing

After cleaning off pencil marks and surface dirt with a solvent cleaner such as Cleanwoode, hand-sand the cradle and finish. I stained the wood cherry, and applied two coats of Transparent Waterlox and one of Antique Satin Waterlox. Upholstery foam 2 in. thick covered with a plastic shower curtain makes a good pad for the cradle. **PM**





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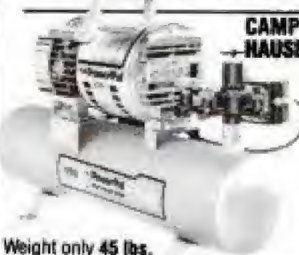
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DRIVING TOYOTAS

(Continued from page 136)

the SR5 retains last year's Corolla floorpan, wheelbase and suspension system. It uses MacPherson struts fore and a four-link live axle with coil springs aft. Both ends have antiroll bars. This is basically 1983's optional SR5 handling package in that it includes the alloy wheels, wider tires and stiffer suspension calibrations.

The engine for the SR5 Sport is the same 70-hp, 1.6 ohc engine you get in Corolla sedans. Though the SR5 is about 100 pounds heavier than the fwd four-door, it does have better acceleration, thanks to lower transmission and final-drive ratios. These lower ratios mean a slight drop in fuel economy (EPA estimates 31/41).

The SR5 Sport Liftback comes only with the five-speed gearbox, while the coupe is available with either manual or automatic transmission. The SR5 automatic is a four-speed unit with overdrive high (0.688:1) and computer-controlled lockups in the top three ranges. This automatic comes with a switch that lets the driver choose any of three shift-point settings—ECONOMY, NORMAL or POWER. These, with the aid of the computer, choose optimum shift points for the mode selected. Frankly, I

couldn't feel any difference in acceleration no matter which mode I chose.

An optional sport seat for the SR5 not only has knee and lumbar adjustments, but settings for the wings. I liked the adjustability, but felt the seat bottom sloped radically toward the rear—too much like sitting in a barrel.



Transversely mounted, 1.8-liter diesel in the Corolla delivers 56 hp and up to 60 mpg. Camry's turbocharged diesel has 73 hp.

New to the Camry line is the same optional 1.8-liter diesel as in the Corolla, but in the Camry it's turbocharged. Toyota engineered and manufactures the turbocharger in-house. It boosts power from 56 to 73 hp at 4,500 rpm, making the car acceptably lively. The new turbodiesel Camry is available

only with a five-speed manual transmission.

The boxy Tercel wagon now boasts two-wheel drive as well as 4x4. This move not only makes the Tercel wagon less expensive, but gives it slightly more cargo-deck capacity.

The '84 Celica's main change centers on the grille, which now has fully retractable headlamps. And all new Celicas get the ohc 2.4-liter Four that used to come only in last year's up-option GT and GT-S. The '84 GT-S gets independent rear suspension and four-wheel disc brakes. Instrument panels have been changed, and really terrific multiadjustable sports seats are available.

The 1984 Supra's most noticeable change is its rear body treatment, which combines the taillights with a Supra logo. The twin-cam, 2.8-liter Six rates 10 more horses than last year, going to 160 hp thanks to higher compression and a bigger intake manifold.

Toyota's new Van Wagon (*Imports & Motorsports*, page 10, Sept. '83), Cressida and Starlet remain pretty much unchanged. But watch for the Celica/Supra, the Starlet and even the Cressida to offer some styling and engineering surprises soon. Toyota believes in moving right along. **PM**

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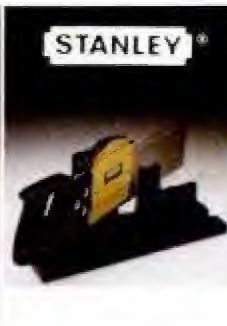


Where hardware isn't a sideline.

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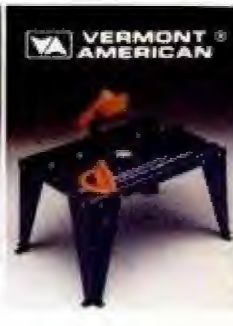
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A five-year or 50,000-mile Protection Plan.* Match it, anyone!
For 1984, we're challenging the competition: Match it! Match Horizon's 5-year or 50,000-mile protection on the engine, powertrain and against outer body rust-through. We give it all at no extra cost, thanks to our confidence in The New Chrysler Technology. Who can match it? No one.

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PM SOFTWARE MONITOR



Getting there is most of the fun

There are a lot of flight simulators for various personal computers. And they all try to give you the feeling of flying by using a flimsy game control as a control yoke and the screen as a cockpit window. Almost all are obvious simulations that don't really "fool" you into thinking you're flying.

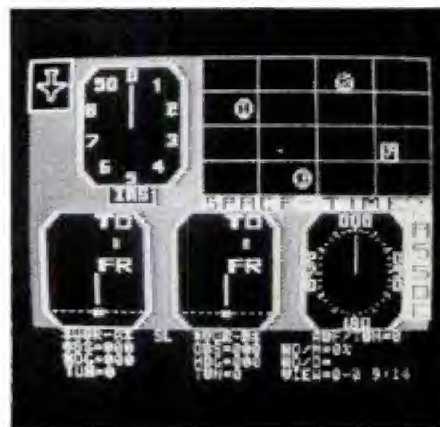
But a new program, *Air Nav Workshop*, or *ANW*, tackles the idea of simulating navigation, not flight.

The navigation of a computer aircraft does not depend on an out-of-the-cockpit view or hard-to-simulate physical controls. Instead, this program gives the cockpit instrumentation needed to use various navigational aids (navaids). The airplane (and you'll soon stop thinking

of it as just a video screen) is equipped with two functional VOR (very high frequency omnidirectional range) receivers and an automatic direction finder (ADF) which can access the NDB (or nondirectional radio beacon navaids).

If all of this sounds like alphabet soup, the included manual is an excellent guide on what it takes to steer under the stars. Included on disk are two separate programs that will introduce you to aircraft navigation.

For armchair pilots, or real flyers brushing up on navigation, this program (\$40) is tops. It's for the Apple II from Space-Time Associates, 20-39 Country Club Dr., Manchester, N.H. 03102. (603) 625-1094.—N.S.



Cockpit Instruments in *Air Nav Workshop* simulate real aircraft navigation. The program is for the Apple II computer.

The word on *The Word*

Bible scholars study such questions as: How many times does the Gospel of St. John mention the word "love"? Weighty Bible dictionaries can give answers to such questions within minutes. But this is the age of the microchip, and even Bible scholars would prefer to do their research in seconds rather than minutes.

Enter *The Word* processor, a set of four to seven floppy disks, depending on the make of your computer. For \$199, you get all 4.5 million characters (36 million bits) of the King James Version of the Bible. In just 45 seconds, *The Word* produced on my Apple II screen a list of 46 references to the term "love" in John's Gospel.

Still, if you're a Bible scholar, you'll need more than *The Word* to do your research. The computerized Scripture

doesn't list Greek, Hebrew and Aramaic meanings, taking some of the interesting aspects out of Bible study. For instance, a good concordance will show you that of the 46 references to the word "love" in the Gospel of St. John, 37 are translated from the Greek word "philos" (brotherly love) while nine are from the Greek word "agape," the kind of love that might grow between people facing a common enemy.

Despite the drawbacks, *The Word* may eventually become a tool for Bible scholarship. Its creators are working on follow-up floppy disk Bibles. The current software is in the King James Version. Having Revised Standard and New International computerized Bibles could make up for the loss of classical language cross-references. *The Word* is from Bible Research Systems for many popular computers.—D.E.

Chess for fun

Those who have played chess with the computer program *Sargon II* will be most happy to hear that *Sargon III* is nastier in the opening, trickier in the midgame and a real pain in the end.

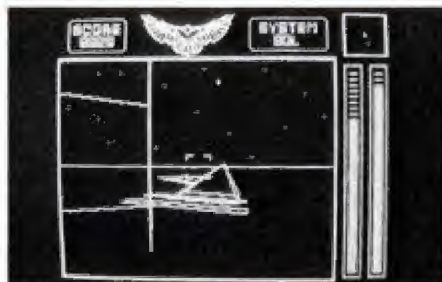
The graphics include a labeled chessboard so that entering a move no



Sargon III lets you replay a game or even take moves back to set up a chess problem.



Last Gladiator (\$35) from Software Art puts you in the coliseum with weapons from swords to pistols. It's now on Apple II, soon to be on Atari and others.



Stellar 7 is one of the best, fastest arcade games we've ever seen. It sells for \$35 and is manufactured by Software Entertainment Co. for the Apple II computer.

longer means memorizing the "algebraic" system. Control-key commands allow you to replay a game move by move and even take moves back and set up a problem situation. But the most fun is to watch *Sargon III* think. You can switch to a quick-scrolling display of the moves the program is considering. *Sargon III* (\$50) is from Hayden for most popular computers.—N.S.

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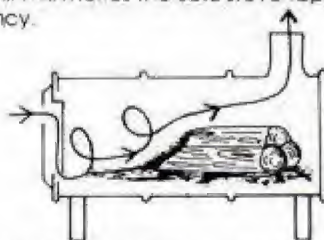
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bottom kit
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Kit converts 55 gal., or 30 to 15 gal., drum (not supplied) into high capacity stoves.

You've seen our ads and read unsolicited testimonials from folks just like you for many years. Before you spend \$400 to \$500 on a wood heater, try a **SOTZ HEATER** kit. If (within one year) you don't agree it outperforms any wood heater money can buy or (within 10 years), if the kit cracks, warps or burns up, your money will be refunded, including shipping charges.

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"A GOLD STAR"

In the four years since I first ordered a two-barrel kit, I've began to wonder how I ever got by without you. You've saved me much money and labor, and also restored my faith in American products and business. I sold that first kit, after using it for three seasons, because of moving to Florida. There I purchased your 30 gallon kit for a fireplace conversion. Again, I was more than satisfied. Now, having moved back to Indiana, I again need the 2-barrel 55 gallon kit. I will have less invested in all three of your stoves than many of my neighbors spent on one ready-made stove. I have also used the Monster Maul for two years now, and wouldn't be without it. I spent more replacing handles in my conventional maul than yours costs. I recommend your products to everyone, and hold your business in the highest regard. Your products are the best investment a person can make, if they are using wood heat in their home, workshop, or business. I'm

giving you an A+ and a gold star.

Larry E. Peterson, Connersville, IN

I CAN'T BELIEVE

I got my 2 drum heater working like you said it would. I built mine with a 30 H kit, I put a 35 gal. on top of a 40 gal. ... works better than my neighbor's \$500 heater with less fuel. I have had people see this in operation they say "I can't believe it." I am ordering a 55HDD kit today. Well pleased with this unit and can't say enough for it and your service.

Jay E. Neal, Strattanville, PA

"THE COMEDIAN"

I knew there was a catch to the stove kit and Monster Maul. For the past 3 years I've read your ads and successfully resisted. Finally I weakened and bought both the maul and kit for the 2 Barrel stove and as I suspected, there had to be a catch. It does heat a basement and upper floor of a 25'x40' building. I'll admit that it does hold the fire for 16-18 hours effort-

lessly. Sure there are not hot spots or sparks. And maybe the ease of assembly does impress me. Some of my neighbors even agree that the maul is better than a 6-pak of wedges and axes. But: If this whole set-up is so all fired great, efficient, convenient, dependable, clean, and low cost, why won't my wife volunteer to cut the wood?

Dr. Larry Vickrey, Louisiana, MO

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